The Electrical Industry's Weekly Magazine May 23, 1960

Electrical World

Price 50 Cents

A McGraw-Hill Publication

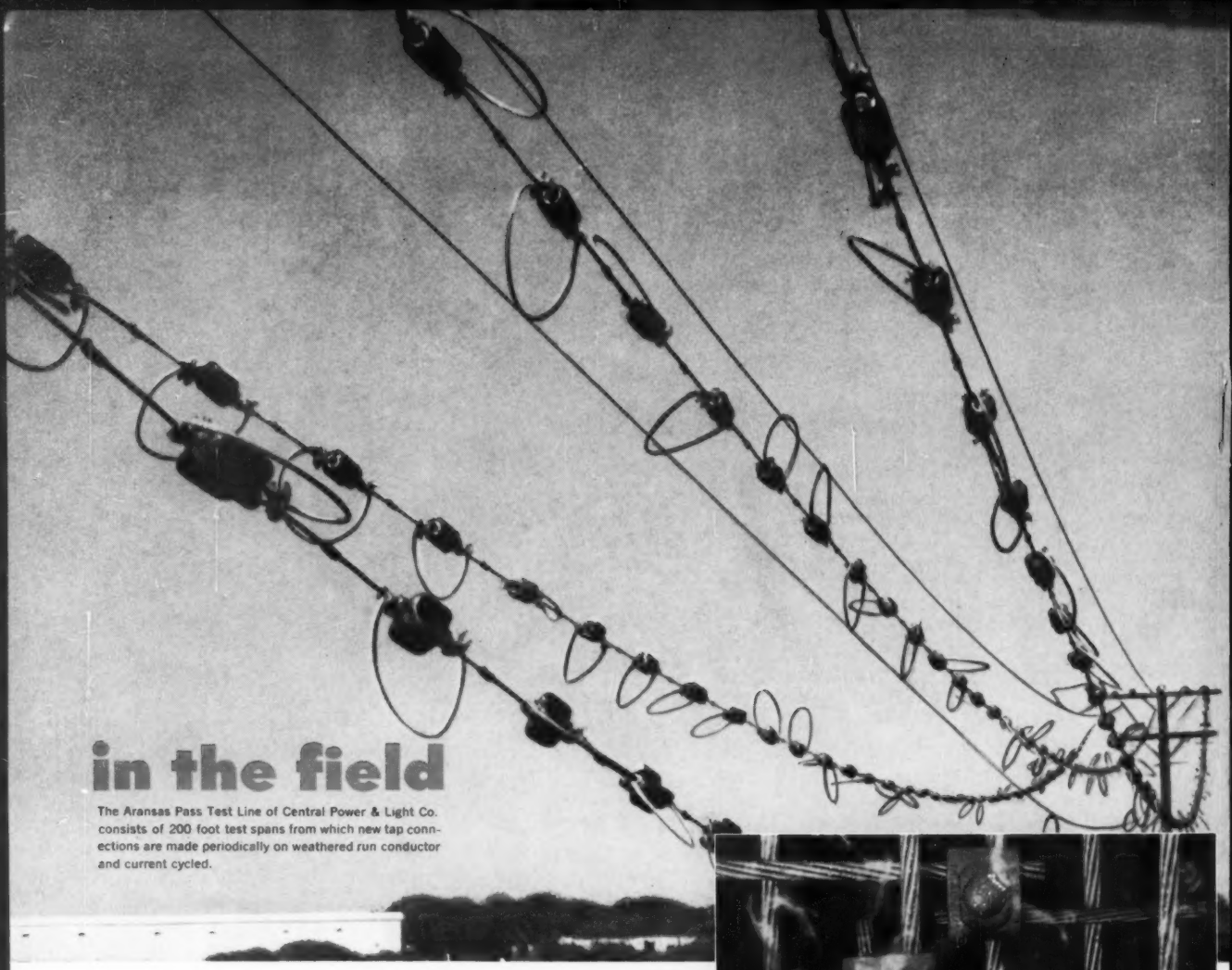
In Portland, Ore...

Developers Prefer Residential Distribution

Underground

... page 74

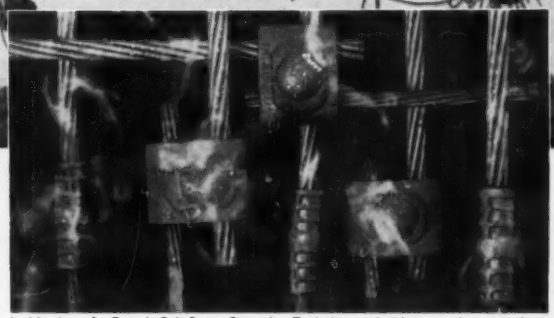
UNIV MICROFILMS INC
EDITORIAL DEPT
313 N FIRST ST
ANN ARBOR MICH C



in the field

The Aransas Pass Test Line of Central Power & Light Co. consists of 200 foot test spans from which new tap connections are made periodically on weathered run conductor and current cycled.

...and in the lab



Inside view of a Burndy Salt Spray Corrosion Test shows what happens to connectors and cables of dissimilar metals when exposed to severe atmospheric conditions.

BURNDY RESEARCH

CONCENTRATES ON THE DEVELOPMENT OF BETTER ELECTRICAL CONNECTIONS

Burndy's field research with Central Power & Light on weathered overhead lines is expected to provide valuable information on connector installation practices, and possible data for the future design of connectors and cables with longer and more predictable life spans.

Burndy's research has produced: Massive Aluminum Tap—TAPIT®; Single Sleeve ACSR Splice—UNISPLICE™; Pre-insulated Service Entrance Splice—INSULINK®. Burndy research will continue to concentrate on the development of better electrical connections.

BURNDY

58-18

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Electrical World

Vol. 153, No. 21 MAY 23, 1960

Published for 86 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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Uncoupled Generators Give Kvar

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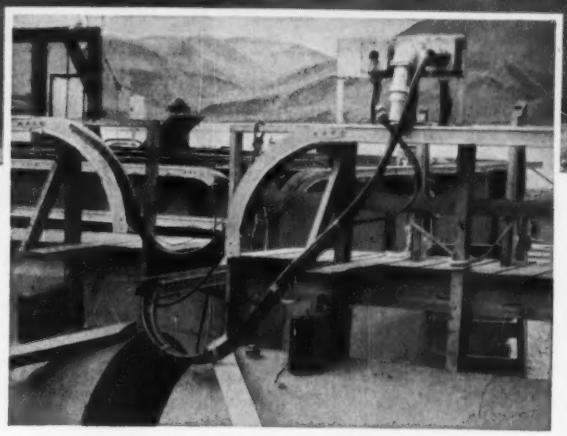
THIS IS THE "FISH NET"—stretching more than a half-mile across the reservoir behind Idaho Power Company's Brownlee Dam in the Hells Canyon reach of the Snake River, bordering Idaho and Oregon. The migrant fish facility, designed to save salmon and steelhead from a drop over the spillway of the 395-foot-high Brownlee Dam, depends on Okolite-Okoprene 600-volt power and control cable for continuous, all-weather operation. Fish trapped at three skimmer-barges attached to the net are taken by specially designed trucks for release down-river.



HERE IS CABLE'BILITY on the job, providing power to two 21,000-gallon-per-minute pumps which create artificial currents that lure the fish into channels in the trap. Multi-conductor control cable also enables a complicated maze of control equipment—almost completely automated—to be operated both from the barges and a shore station.

Cable'bility at work

Idaho Power chooses Okolite-Okoprene cables for power and control at "world's biggest fish net"

Cable'bility (cā'ble·bil'·i·ty) *new word. Noun.* **1.** Ability to design and manufacture electrical cables that give outstanding performance. **2.** Having long background and wide experience in cable research and application. **3.** Possessing keen understanding of customers' problems. Implies eagerness to serve faithfully and dedication to progress. **Syn.** The Okonite Company.

Okolite-Okoprene 600-volt power and control cable is at the heart of Idaho Power's new fish conservation facility behind Brownlee Dam in Hells Canyon, on the Idaho-Oregon border.

The "world's biggest fish net"—300,000 square feet in size behind the giant Snake River dam—depends on nine-conductor Okolite-Okoprene control cables to carry current to almost completely automated control equipment. And Okolite-Okoprene three-conductor power cables provide power to motors driving two 21,000-gallon-per-minute pumps which create artificial water currents, luring fish into channels in the trap.

Both Idaho Power and International Engineering Company, the consulting engineers, specified Okolite-Okoprene for the project, seeking maximum operating dependability. The cables are constantly exposed to weather and, in the center section, are submerged in water. Their flexible stranding helps them withstand the movement of the barges on the lake, as well as handling during removal of barge sections or traps.

For the full story on Okolite-Okoprene, write for Bulletin EW-1085. The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, N. J.

where there's electrical power . . . there's **OKONITE CABLE**

7228-A

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ELECTRICAL WORLD

Vol. 153, No. 21, May 23, 1960

Published weekly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948). Founder. Executive, Editorial, Circulation and Advertising Offices: McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Printed at 90-129 North Broadway, Albany 1, N. Y. See panel below for information regarding subscriptions or change of address.

Officers of the Publications Division: Nelson L. Bond, President; Shelton Fisher, Wallace E. Truesdell, Senior Vice Presidents; John R. Callaham, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator. Officers of the Corporation: Donald C. McGraw, President; Joseph A. Gerardi, Hugh J. Kelly, Harry L. Waddell, Executive Vice Presidents; L. Keith Goodrich, Vice President and Treasurer; John J. Cooke, Secretary.

Subscriptions are solicited from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields; and from consulting engineers and electrical engineers in industry. Position and company connection must be indicated on subscription orders. Send to address shown in box below.

United States and Canada subscription rate for individuals in the field of the publication $6.00 per year; single copies 50 cents. Other Western Hemisphere and the Philippines $20.00 payable in advance and other countries $30.00 payable in advance.

Second-class postage paid at Albany, N. Y. Title registered in U. S. Patent Office.

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SUBSCRIPTION AND ADDRESS CHANGES: Send subscription correspondence and change of address to Fulfillment Manager, ELECTRICAL WORLD, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

Postmaster . . . Please send form 3579 to Electrical World, 330 W. 42nd St., New York 36, N. Y.

LETTERS

Davis DeBard, Respected Industry Figure

▶A few men rise above their own jobs to become respected industry figures. Such a man was Davis M. DeBard, formerly with Stone & Webster Service Corp and later with Reddy Kilowatt, Inc. We are honored to share these letters with our readers:

To the Editor:

It is with much regret that I have learned of the death of my long-time friend and associate, Dave DeBard. For years he was an active leader in the councils of the electric industry, always pushing and driving aggressively for increased industry sales effort; seeking to promote the development, the manufacture, the public acceptance, and the active marketing of new load-building appliances; campaigning for adequate wiring and new developments in wiring to accomplish this—in fact, attacking any obstacles standing in the way of greater use of electricity by the American public.

He took an active and prominent part on many committees of the Edison Electric Institute. His dinners at EEI conventions came to be traditional events. I can see him now in the midst of . . . sessions of various committees, advancing his ideas and urging adoption of the courses he favored . . .

Howard S. Bennion
2136 Hubbard Ave
Salt Lake City 8, Utah

▶Bennion is former managing director of EEI.

To the Editor:

. . . Davis had a host of friends and was practically a walking clearing house for progressive ideas and developments throughout the electric industry as well as the gas industry with which many of his client companies also served over a long period.

Davis was, therefore, not only one of the best known sales engineers in the business, but had a remarkable memory and the ability and desire to serve his friends, either personal or business. I don't think I have ever known a man who was more progressive than Davis . . .

Ashton B. Collins, President
Reddy Kilowatt, Inc
New York 17, N. Y.

To the Editor:

Dave was a great man—being full of ideas and a tireless worker for the development of the electrical load. He searched Europe for low cost devices that could be promoted to the low income mass market.

More important, however, was the magnificent job he did during the last war to bring members of the electrical industry, here and in England, closer together. We came to know, out of the horse's mouth as it were, their personal problems and to appreciate their courage and determination during some of the gravest times.

Sam B. Williams
Jamestown, R. I.

▶Williams is a former editor of Electrical World.

MOLONEY DISTRIBUTION TRANSFORMERS ARE DESIGNED TO MEET ALL SYSTEM REQUIREMENTS

Comparative analysis of distribution transformers invariably leads to one conclusion . . . the best distribution transformer has all characteristics of design carefully developed in respect to their contribution to system efficiency, dependability and economy.

In Moloney Distribution Transformers, no one feature, electrical or mechanical, is radically improved at the expense of another. Instead, each part of the design is carefully considered and balanced with the others, to provide a distribution transformer that will give the best all-around system performance.

Utility systems benefit from this philosophy of design because every Moloney Distribution Transformer feature is designed to perform in the best possible manner compatible with every other aspect of the design, and thus provide "More Power To You."

Desirable Characteristics of Moloney Distribution Transformers Include . . .

Low Core Loss — Impulse Strength
Low Exciting Current — Low Impedance
High Overload Capacity — High Efficiency

Here Is How They Are Achieved.

SUPERIOR PERFORMANCE BECAUSE...

MOLONEY ELECTRIC CO.

Since 1896 . . . ***MORE POWER TO YOU***

1 Design

Computers review hundreds of possible designs in a relatively short time, to obtain design parameters which promise to develop into the best all-around distribution transformer design. Design engineers review the computer data. Then guided by Moloney's extensive experience in transformer design and also by utility requirements, they prepare the final design.

2 Low Core Loss and Exciting Current

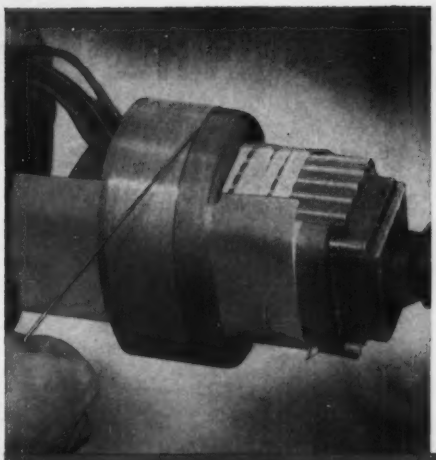
Skillful application of high grade cold rolled grain-oriented silicon steel, carefully handled and annealed, gives low core loss and exciting current. The core design uses one turn laminations with the ends butted one against the other. To minimize the required exciting current, the butt joints are staggered, providing a high permeability path for the flux.

3 High Overload Capability

Corrugated pressboard, strategically placed, forms cooling ducts which expose a larger area of the winding surface to the oil, thereby reducing the winding gradient. The result is a lower hottest spot temperature under all conditions of load. Therefore, under conditions of overload, any loss of transformer insulation life is minimized.

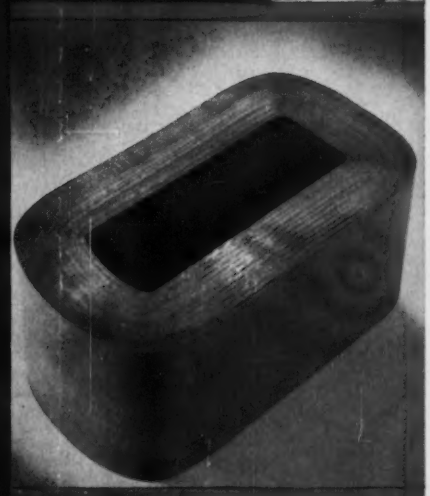
MEBO-3

SALES OFFICES IN ALL



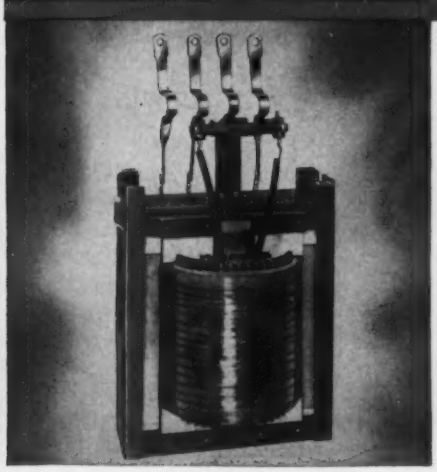
4 High Impulse Strength

At the line ends of the high voltage coil, extra insulation is provided between layers of the winding, and cording is placed between adjacent turns. At higher voltage ratings the high voltage winding is sectionalized to reduce the voltage between adjacent ends of succeeding layers. This practice reduces the turn-to-turn and layer-to-layer stresses and, consequently, gives the coil high impulse strength.



5 Low Impedance, Improved Voltage Regulation

The low-high-low sequence coil design used in Moloney Distribution Transformers is one of the contributing factors to low impedance. Because of this low impedance, Moloney Distribution Transformers have a lower internal voltage drop under all conditions of load. The result is improved voltage regulation which means customer satisfaction and increased revenue.



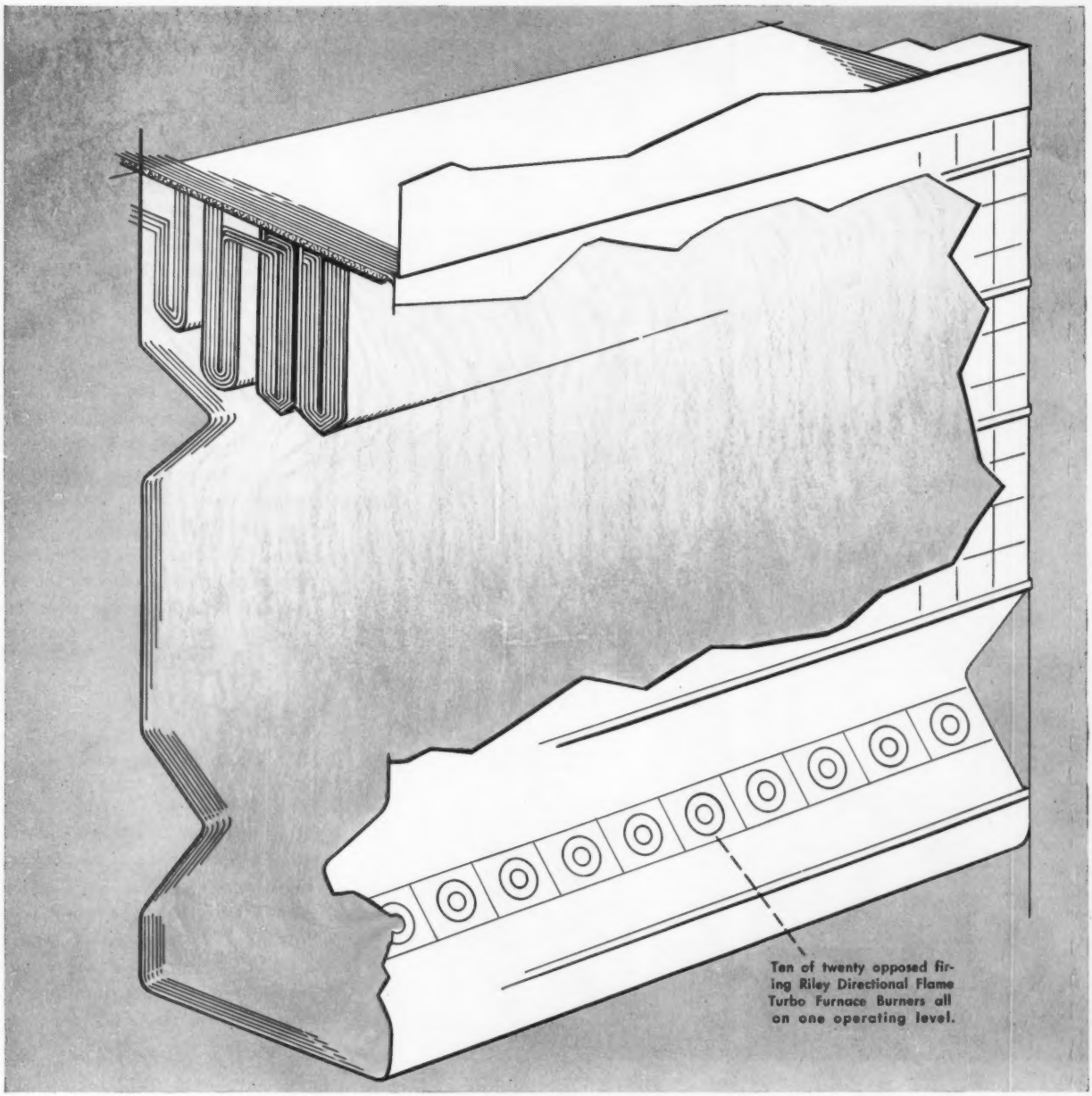
6 High Efficiency

The efficiency of any transmission and distribution system depends wholly upon its components. The high efficiency of Moloney Distribution Transformers, resulting from low total losses, is one of the reasons why Moloney Transformers, installed in your system, afford . . . "More Power To You."

BY *"Doing What Comes Naturally"*

The RILEY

Produces Uniform



Sales Offices: Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Jacksonville, Kansas City, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, Portland, St. Louis, St. Paul, Salt Lake City, San Francisco, Seattle, Syracuse.

TURBO FURNACE

Exit Temperature With *NATURAL* Flow of Furnace Gases

Uniform, safe gas temperatures across the full width of a boiler's high pressure elements is a vital requirement for continuous, efficient, low cost, trouble-free boiler operation, especially in high pressure, high temperature units. With a Riley TURBO FURNACE this objective is obtained . . . and . . . WITHOUT using costly auxiliary methods for distributing furnace gases.

In the TURBO FURNACE all fossil fuels — gas, oil, coal — are burned at the base of the furnace with combustion extending evenly from sidewall to sidewall. The cutaway illustration shows combustion gases rising within the furnace envelope in a uniform wall to wall column resulting in a minimum variation of metal skin temperatures across the full width of both the superheater and the reheater. The maximum variations above normal operating temperatures are well within safe alloy limits assuring long tube life.

Because of natural, uniform furnace gas flow and distribution steam temperature control is also simplified, furnace slagging is minimized — deslagging equipment is rarely required. Flyash and air pollution problems are minimized. Higher heat releases and wider single undivided furnaces are possible.

The advanced design of the TURBO FURNACE represents an important step forward toward more efficient boiler operation. Because any available fuel can be burned at any time without major alterations the TURBO FURNACE boiler is the ideal "Convertible" furnace for today's and tomorrow's fuel economics.

A new graphically illustrated TURBO FURNACE catalog is available. Ask your Riley Representative.

Some Typical Riley Turbo Furnace Boiler Installations.

Delaware Power & Light Co.
Delaware City Power Station
3 Units — 500,000 lbs/hr each
1425 psig — 950F Fuel — Fluid Coke

Texas Electric Service Co.
Permian Basin Steam Elec. Station
1 Unit — 825,000 lbs/hr
1750 psig — 1005/1005F
Fuels — Gas, Oil, Future Coal

Dallas Power & Light Co.
Northlake Steam Elec. Station
2 Units — 1,200,000 lbs/hr each
2125 psig — 1005/1005F
Fuels — Gas, Oil, Future Coal

Louisiana Power & Light Co.
Sterlington Steam Elec. Station
1,550,000 lbs/hr
2125 psig — 1005/1005F
Fuels — Gas, Future Oil, Coal

Louisiana Power & Light Co.
Little Gypsy Steam Elec. Station
1,650,000 lbs/hr
2125 psig — 1005/1005F
Fuels — Gas, Oil

Florida Power Corporation
Turner — Unit No. 4
600,000 lbs/hr
1750 psig — 1000/1000F
Fuels — Gas, Oil

New Orleans Public Service Co.
Michoud — Unit No. 3
1,550,000 lbs/hr
2325 psig — 1005/1005F
Fuels — Gas, Oil, Future Coal

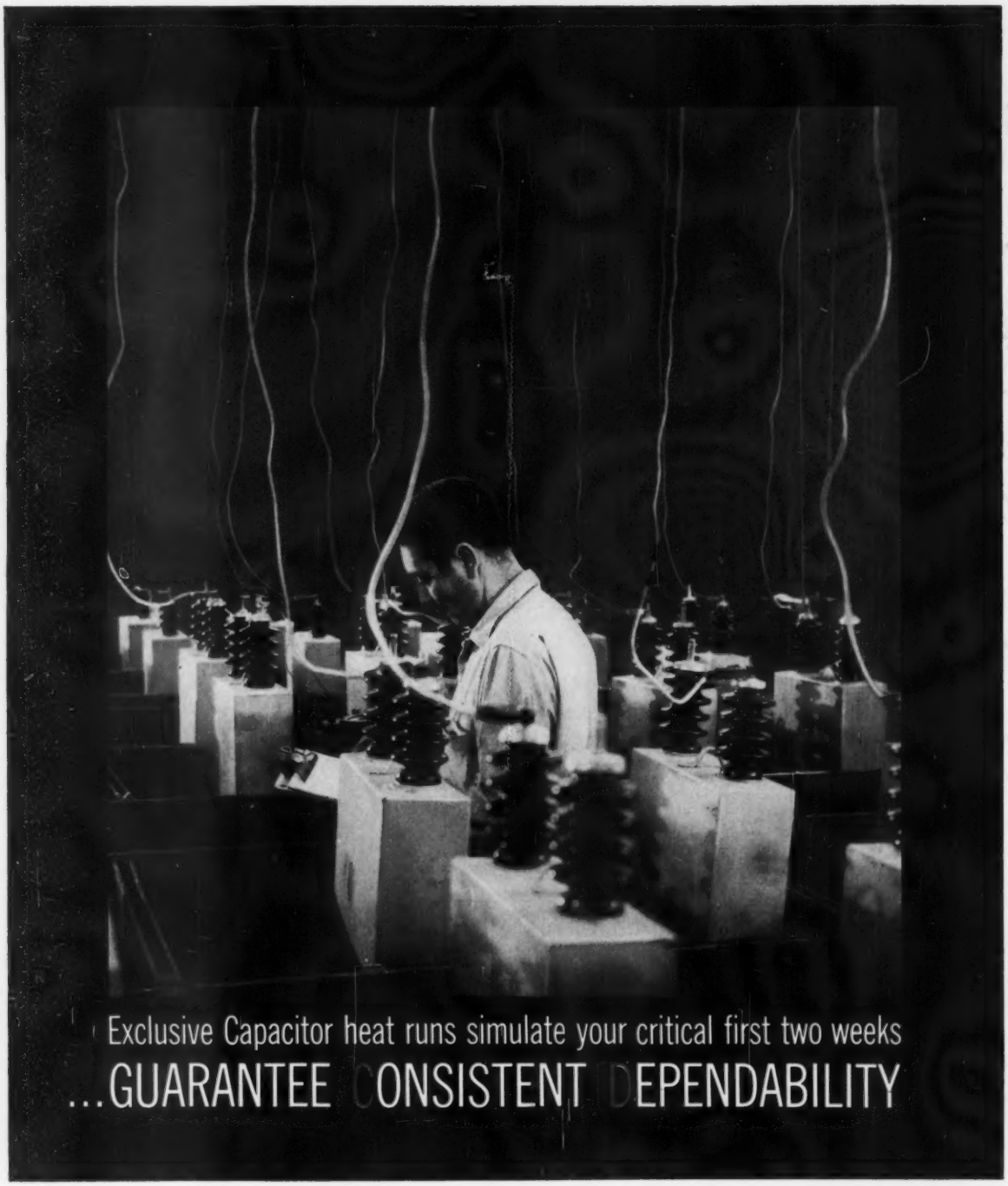
Manila Electric Co.
Rockwell Station — Units 6, 7
430,000 lbs/hr each
2160 psig — 1005/1005F
Fuel — Oil

RILEY

STEAM GENERATING & FUEL BURNING EQUIPMENT

A careful survey of your plant by a qualified consulting engineer could show ways of making substantial savings in power costs.

RILEY STOKER CORPORATION • WORCESTER, MASSACHUSETTS



Full voltage heat runs and energization test—actually the equivalent of a capacitor's crucial first two weeks on the line—are conducted on every C-D capacitor before shipment. Only C-D capacitors are put to this test! ■ Additional capacitance, leak and dielectric tests have produced a matchless record of 99.6% reliability for the entire C-D line—your assurance of longest capacitor service life. True capacitor value... lowest volts per mil... power losses far below NEMA limits.

FPE **CORNELL-DUBILIER POWER CAPACITORS**
FEDERAL PACIFIC ELECTRIC COMPANY • 333 HAMILTON BOULEVARD, SO. PLAINFIELD, N. J.

The Electrical Week

LATE NEWS ▶

Foreign bidders are apparently low to supply turbines for Flaming Gorge in Utah and McGee Bend in Texas. Hitachi (Japan) submits $595,792 bid on three 50,000-hp Flaming Gorge turbines. English Electric bids $1,075,547 ($1,165,080 with 6% Buy American differential and foreign inspection fee) for two 41,300 Kaplan hydraulic turbines for McGee Bend. Second low on Flaming Gorge is Ames Lessel, Springfield, Ohio, at $798,550. High bidder on McGee Bend is American Elin (Austria) at $1,489,490.

Sentencing of companies and individuals in antitrust suits is delayed until May 25 as Chief Judge J. Cullen Ganey asks for more information from defense and prosecution.

IUE demands on GE will be worked out in a New York meeting May 24-25. Union wants negotiations to start a month early—June 1. Meanwhile, the UE strike against Westinghouse seems destined to be a long one. Both sides say no progress is being made.

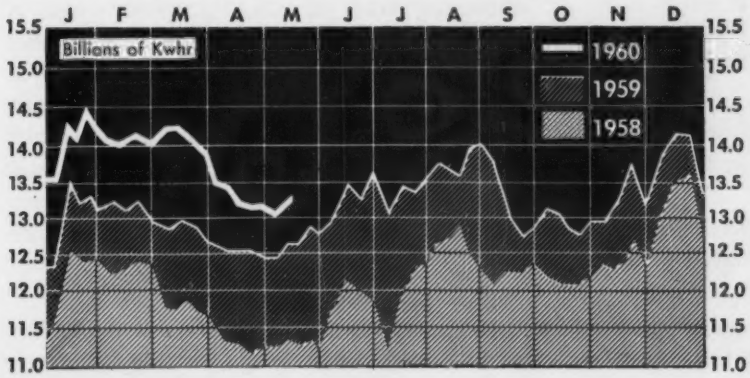
"Pathfinder" A-plant gets construction green light from AEC. The 62-Mw Northern States Power plant will be in Sioux Falls, S. D.

N. Y. State looks for safe A-waste storage sites. State Office of Atomic Development hires Vitro Engineering to do the searching. A reprocessing plant is in the offing.

Democrats appoint Clyde Ellis to advisory group on resources for their 1960 convention policy statement.

Management changes . . . F. L. Fletcher elected exec vp of Sierra Pacific Power; he moved from Central Illinois E&G . . . Other S-P vps are Roy Torvinen, Neil W. Plath and Merle H. Atcheson.

WEEKLY POWER OUTPUT—UP 5.3% (Week ending May 14), Kwhr 13,350,000,000



Per Cent Change From Previous Year

	Apr. 30	May 7	May 14
Total U. S.	+ 6.0	+ 3.8	+ 5.3
New Eng.	+ 4.7	+ 7.5	+ 7.9
Mid. Atlan.	+ 6.2	+ 6.3	+ 4.9
Cent. Ind.	+ 3.9	+ 2.1	+ 4.9
West. Cent.	+ 6.5	+ 3.9	+ 5.4
Southeast	+ 6.4	+ 3.8	+ 5.9
South Cent.	+ 5.7	− 2.0	− 1.1
Rocky Mount.	+11.4	+ 8.0	+ 7.5
Pacific			
NW	+ 9.5	+ 6.5	+ 7.8
SW	+ 6.8	+ 5.0	+ 7.7

Seasonally Adjusted Index 270.2
Week Ago 267.0 Year Ago 255.4

Source: Edison Electric Institute

Preview of This Issue

EVENTS ▶ **Early stages of Harris subcommittee hearings fail to reveal serious** cases of influencing FPC Commissioners by industries **(p 62)** . . . Interior Department releases "yardstick" transmission plan and defines marketing areas for Upper Colorado project **(p 64)** . . . Washington Public Power Supply System succeeds in getting some delay in hearings on Nez Perce and High Mountain Sheep proposals. New dates are given **(p 65)** . . . Purchasing and stores men hear plea for utilities to centralize authority for materials management **(p 66).**

ENGINEERING ▶ **"B" meter and enclosure solves polyphase metering problems** for Detroit Edison **(p 70)** . . . Seattle City Light finds that blending engineering and esthetics in substation design helps cut opposition from residents **(p 72)** . . . Also in the Northwest, Portland, Ore., real estate men share costs of residential underground distribution with Portland General Electric. They find it helps them sell homes **(p 74)** . . . Ontario Hydro uses uncoupled generators as synchronous condensers to supply kvar to Toronto **(p 81)** . . . Arizona Public Service employs computer to determine transmission tower placement **(p 84).**

PROCUREMENT & PRODUCTS ▶ **Reaction to GE's new pricing policy is varied and vague,** but the new pricing platform is gaining attention . . . TVA estimates it will

Politics and Public Power

OPPOSITION TO THE 'TRIMBLE BILL'

It is interesting to note that some of the opposition to H.R. 8, the so-called "Trimble Bill," is based not on the bill's alleged purpose—to establish water and power policy governing the development of the nation's water resources—but on some of the particulars which the bill proposes to implement that development.

The bill, according to Rep William C. Cramer (R-Fla.), "contrary to its proponent's views, does not provide a valid or sound national water policy, although such a legislative policy is needed."

Cramer, a member of the House Public Works Committee, has been fighting for some time against what he terms "attempts to raid the U. S. Treasury by public power people." He has opposed the bill in committee, and will continue to do so if and when it comes before the House.

Cramer questions two standards the Trimble Bill seeks to establish:

- A 100-year repayment period for water projects costs. Federal policy presently calls for 50 years.
- The incremental-method formula for allocating costs of multi-purpose projects. With respect to power, the bill says costs shall be determined as being the difference between the costs of the project, with and without power installations. This would mean, for example, that the cost of a reservoir in a multi-purpose project would have no part of its cost charged against power, despite the fact that the waters in it would be used to generate electricity.

Cramer feels the 100-year repayment formula would result in a lowering of power

burn 300 million tons of coal during coming decade **(p 94)** . . . Designs of aluminum and steel towers for GE's Project EHV have been completed, respectively by Aluminium Ltd of Canada and Commonwealth Associates . . . Ingersoll-Rand builds 22,000-hp boiler feed pump for Sporn's No. 5 **(p 96)** . . . Computer system for small companies introduces a new input method . . . Pole-mounted tensioner pulls 1,000 lb tension and handles conductor to 397.5 MCM AAC capacity **(p 106).**

MANAGEMENT ▶ **The average utility buyer spends about $8,000 a day** in doing his job. This makes him busy . . . but is he efficient? A 37-utility survey points up wide and interesting variations in buyer work output **(p 119)**; and a 68-utility survey shows most utilities are satisfied with their disposal programs—with some notable exceptions **(p 120).**

SELLING ▶ **Good street lighting continues to cut crime.** Three new Midwest cities report crime and traffic accident decreases with new installations. Bonus: added nighttime business **(p 127).**

NEXT WEEK **Be sure to read EW's first Small Systems Engineering Report.** This 12-pager contains valuable information for small-system operators.

rates to preference systems and users.

And the incremental formula would assign a relatively small part of federal project costs to power users, "creating cheap federal power and unsound projects."

The net result of these two provisions in the bill would be, said Cramer, "that on one hand we would broaden the water basin development program to permit uneconomically feasible projects to be constructed—as part of the whole . . .

"Then we would lower the charges to be allocated to electric power— which are reimbursable—by charging more to non-reimbursable uses such as flood control and recreation, thereby again loading more to the burden already carried by the taxpayer."

And Cramer is not alone. A number of federal agencies have already gone on record opposing some of its provisions, especially the one covering the incremental-cost method.

General E. C. Itschner, head of the U. S. Corps of Engineers, has pointed out that "The effect of this provision would be to relieve one purpose—power—of the necessity of paying for its share of that part of the reservoir which serves more than one purpose." Therefore, the Bureau of the Budget, the Corps of Engineers, Interior Dept, Federal Power Commission, and the Comptroller General all object to it.

Itschner supported his point by saying, "It seems unfair to the nation's taxpayers . . . if those who use the power do not pay a fair share of this joint cost."

It would be compounding the alleged unfairness if members of the House did not fairly consider these objections if and when they have to make up their minds (and votes) on this important piece of legislation.

Executive Reader

American electricity consumers must be a little touchy, for it is suggested in the Electrical World (New York) that there is objection to the use of the term "demand" in connection with their loads. Apparently the electrical utilities realise this but are at a loss for a suitable alternative. Respondents to an inquiry most frequently suggested "'capacity,' alone or in combination with 'cost,' 'reserve' or some similar modifier." There were other suggestions, none of which seems to me to take the place of "demand." Why should customers be worried about it? It is their demand not that of their suppliers. **Electrical Review 22 April 1960.**

Field tests show that round conduit may be damaged by heavy-duty pavement breakers if ground cover is less than 24 in. over a conduit having a rated crushing strength of 1,200 lb/ft. Unrestricted use of a power tamper on loose fill, over a cover of 36 in. or less, may cause failure of conduit with a crushing strength of 1,200 lb/ft in two-edge bearing. **Effects of Tamping and Pavement Breaking on Round Conduit, Monograph 3402, G. F. Weissmann and D. M. Mitchell, Bell Telephone Laboratories, New York 14, N. Y.**

Moving in the face of tradition, a new electrical ordinance in Salt Lake City, Utah, contains provisions that call for a minimum of 20 circuits for residences; no main switch for up to 30 circuits; all services to be in raceway; 100-amp service entrances for homes less than 1,500 sq ft and 200-amp entrances for larger homes; a range circuit to be installed; licensing and examinations by the state; and a revolutionary fee system for inspections. **Radical New Ordinance in Salt Lake, Laurence E. Baty, Electrical West, April 1960.**

Present tax depreciation rates are inadequate and will not provide the tax depreciation accruals necessary for the reserves against which depreciable property can be charged off in the future. Current tax depreciation rates generally predate technological "breakthroughs" and recent advances in the electrical art. Higher depreciation rates must be taken to provide for the risks and contingencies of the future. **Obsolescence Vs Tax Depreciation for Electric Utilities, C. P. Guercken, Public Utilities Fortnightly, April 28, 1960.**

A potential conflict exists between the board chairman and the chief executive officer of every corporation. Problems arise from an overlap of authority, and their solutions often turn on the functions and personality of the board chairman and his relationship with the other top officers. Three philosophies of the chairman's role are presented in the very different operations of James W. Murray, board chairman and chief executive officer, General Precision Equipment Corp; Louis W. Dawson, board chairman, Mutual of New York; and Dr. Vannevar Bush, chairman of Merck & Co. **It's Tricky Work, Being Board Chairman, Perrin Stryker, Fortune, May 1960.**

Don't Splice It...Loop It

When Cooline L-W clamps are used on distribution deadends, trouble-free jumper loops can be formed quickly, efficiently without cutting or splicing the conductor.

Low-cost Cooline L-W clamps offer many of the advantages of heavy duty Cooline clamps for transmission lines, but are especially designed for the distribution and sub-transmission trend toward larger conductors and shorter spans.

The L-W clamp has a powerful snubbing action which has high holding power without crushing the conductor. The six models in the series cover a range from .2 to 1.3 inches in conductor diameter with more than adequate ultimate strengths.

Installation is simple since no special tools or skills are required. A few minutes with a standard wrench and Cooline L-W clamps are ready to serve the life of the line.

Just look at these many advantages: design that permits the use of continuous jumper loop without splicing conductor . . . convenience . . . high, maintained holding power . . . low installed cost. And the aluminum construction minimizes electrical losses and conductor heating.

It's certainly worth your time to investigate the many advantages of Cooline L-W clamps now.

Distributed by GraybaR ELECTRIC COMPANY

OHIO BRASS COMPANY, MANSFIELD, OHIO

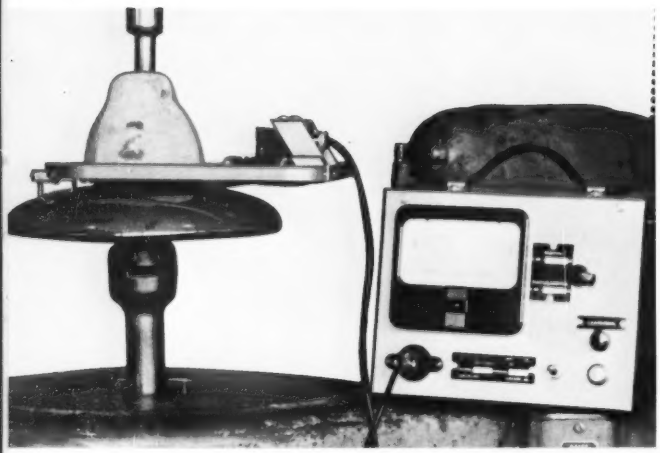
Ohio Brass

HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

O-B FUTURA

So radically improved we had to create new tools to design it . . . test it . . . produce it!



New Design Tools

Precisely what happens to the porcelain barrier between cap and pin when a suspension insulator is under mechanical load?

O-B engineers were the first to know, the first to actually measure - - in millionths of an inch - - how porcelain responded to the radial pressures exerted by the insulator pin. The picture at left shows a gaging instrument and transducer recording porcelain deflection on a completely assembled insulator under tensile load.

The precise knowledge gained from this new tool helped O-B engineers produce the improved porcelain shape of the strongest and most efficient insulator, pound for pound, ever made - - Futura!

New Test Tools

As reported in a recent technical paper (available on request), O-B engineers were the first to devise an accurate method of measuring the lightning puncture strength of high voltage insulators.

The test set-up shown at the left permits the application - - and accurate measurement - - of voltage rates of rise up to 6,000,000 volts per 1/1,000,000th of a second. (Actually, this impulse is so fast that it's "come and gone" before the electrical signal can reach the recording equipment!)

As a result of new tools like this one, the Futura insulator resists a 60 per cent steeper impulse wave than its predecessor!

SUSPENSION INSULATORS with CIS*

*Corrosion Interception Sleeve

Above — Section of Futura Porcelain

New Production Tools

In O-B's new mile-and-a-quarter long mechanized production line are many new tools which help to achieve a higher degree of accuracy . . . uniformity . . . control . . . than was possible before.

This modern equipment assures that the inherent superiority of the Futura design will be faithfully reproduced in every insulator that leaves the production line.

Shown below is a close-up view of the hot-press forming operation which molds the top surface of Futura's new porcelain shape.

A New Insulator!

New design tools, new test tools, new production tools have thus created Futura - - the industry's first new suspension insulator in decades.

Just as important as Futura's extra margin of mechanical and electrical strength, however, is the built-in protection it provides against corrosion damage - - damage which might otherwise destroy this greater strength in the years ahead.

Futura's unique Corrosion Intercepting Sleeve (C.I.S.) has been proved in 15 years of service (to date) in contaminated atmospheres which caused other insulators to fail in as little as four years.

No other suspension insulator protects itself, protects the user, like Futura - - best buy on today's market - - for today *and* tomorrow!

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

10025-H

Exclusive with VAREX®

contacts are made outside the active dielectric under strong spring pressure
CONTAINER
SECONDARY INSULATION
ELEMENT SHOWING EXTENDED FOIL AT END
CONTACT PLATE UNDER SPRING PRESSURE
PACK ASSEMBLY

Varex is the *only* capacitor whose elements are totally free of mechanical insertions in the active dielectric!

Varex engineers have eliminated these mechanical insertions, or tabs, from the dielectric by means of the exclusive "extended foil" design. As shown above, every turn of foil extends beyond the paper dielectric and makes a broad contact with a plate under strong spring pressure.

This exclusive Varex design has thus removed a possible source of mechanical damage during winding, and a cause of higher electrical stress in the adjacent paper dielectric.

This means lower current density, cooler operation, and appreciably longer life for Varex capacitors!

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

10025-H

ALLIS-CHALMERS

New Aluma-Clad switchgear combines long-range economy with

styling for the sixties

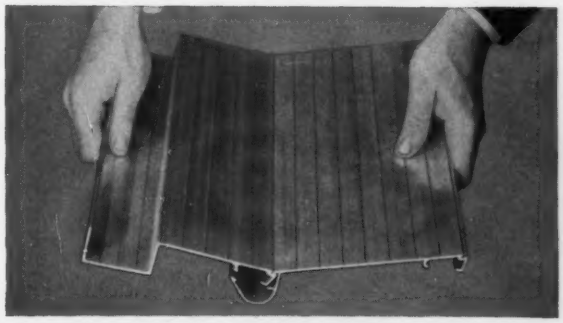
Lasting beauty, long-range economy. You get both with new *Aluma-Clad* switchgear enclosure.

Modern, functional design makes this an innovation welcome in any neighborhood. Ribbed, all-aluminum exterior is soft finished to prevent offensive glare. Color-anodized trim enhances its beauty.

Painting is completely unnecessary! *Aluma-Clad* switchgear can't rust. Its aluminum exterior resists corrosion from salt air and contaminated atmospheres.

Low installation costs! Lightweight aluminum sections dramatically reduce installation time, labor cost. Panels bolt together with aluminum alloy bolts and neoprene gasketing. Because of the unit's light weight and unusual rigidity, simple concrete piers can be used instead of heavy slabs.

Contact your nearby A-C office for complete details on *Aluma-Clad* switchgear, or write **Allis-Chalmers,** Power Equipment Division, Milwaukee 1, Wis. A-1283



Interlocking modular panels snap together to form a permanent leak-proof joint. Extruded vertical joint sections, every six inches, act as reinforcement — provide exceptional rigidity.

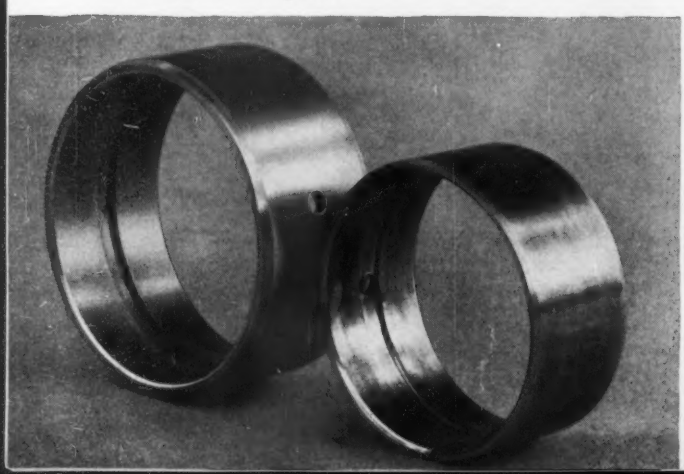
Aluma-Clad is an Allis-Chalmers trademark.

An amazing metal

up to 3 times

"Silver circles" as hard as Swedish steel make your Onan Plant last longer.

Big, brawny bearings—twice the size of many competitors' bearings—give Onan Plants a longer life between overhauls. Onan is built *up* to performance, not down to a price.



To give you greater assurance of top performance, inspectors from an independent laboratory periodically visit our factories to test units and production testing methods.

gives Onan engines
the valve life!

Onan exhaust valves and seats are coated with Stellite, a tough alloy, to greatly reduce wear and burning

Stellite—one of the toughest alloys known—gives the exhaust valves and seats in an Onan engine up to 300% longer life. Scorching punishment—Stellite can take it.

Onan's attention to important details, like valves and valve seats, is what makes Onan Plants so dependable, so long-lasting, so economical.

And, only Onan gives you Performance Certified. Every Onan Electric Plant is run for hours under full load before it leaves our factory to assure ourselves, and you, of getting all the performance and power you paid for. To give you even more assurance, inspectors from an independent laboratory come in periodically to double check our tests and testing methods. Whether you need primary or stand-by generating power, from 500 watts to 230,000 watts, see your Onan distributor. You'll find his name in the telephone classified section in every major city, or write direct.

ONLY ONAN GIVES YOU THIS GUARANTEE

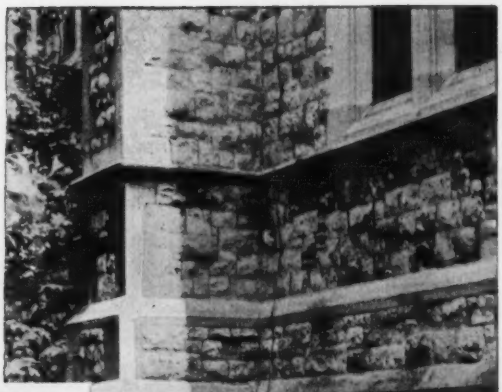
PERFORMANCE CERTIFIED
We guarantee that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.
D. W. ONAN & SONS INC.
Minneapolis 14, Minnesota
Onan

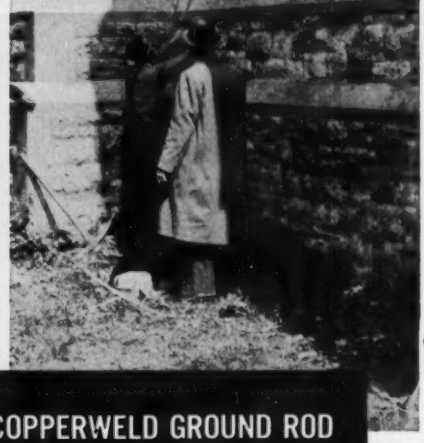
Onan®

World's Leading Builder of Electric Power Plants

D. W. ONAN & SONS INC., 2568 UNIVERSITY AVE. S.E., MINNEAPOLIS 14, MINN.

Dug up in an old English churchyard after 25 years' service





—COPPERWELD GROUND ROD still good for many more years of use

Copperweld Ground Rods never die—they don't even fade away. They go right on protecting your overhead lines and equipment, year after year, after year.

A company in England, specializing in lightning protection, recently exhumed a Copperweld Ground Rod put into service in 1935 to protect St. Matthews Church near London. When originally installed, this 5/8" x 8-foot rod had a resistance reading of 10 ohms—and when dug up and examined, the rod was in perfect physical condition—ready for many more years of use.

For dependable, long-lasting grounds use Copperweld—the only ground rods with a thick copper covering inseparably molten-welded to a strong steel core. They provide stiffness for easy driving and rust resistance for long life. Copper-to-copper contacts throughout assure low resistance. For your protection, each rod is stamped "Copperweld."

COPPERWELD STEEL COMPANY

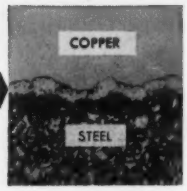
● WIRE AND CABLE DIVISION *Glassport, Pa.*

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, N.Y.

Copperweld®

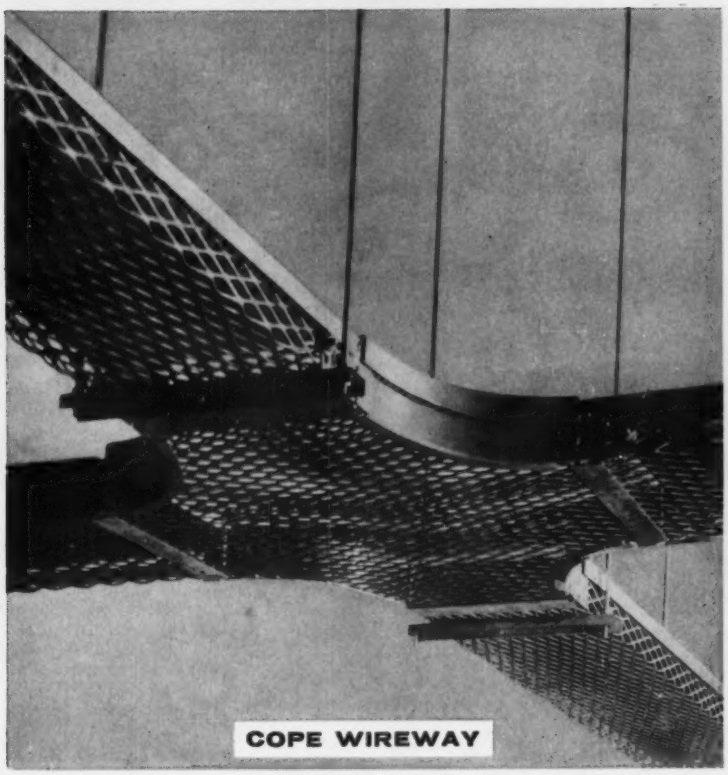
ground rods

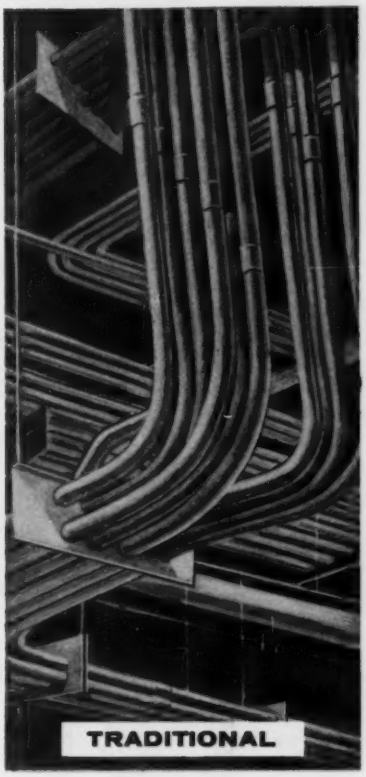
the only ground rods with the **Molten-Weld**



This microphotograph of the Molten-Weld shows how the grains of copper and steel interlock to form a permanent, continuous weld.

COMPARE . . .





ADVANTAGES OF COPE WIREWAY OVER "TRADITIONAL" METHODS OF CABLE SUPPORT

• COSTS LESS FOR MATERIALS

Wireway's strong, expanded type construction uses *less* metal to handle *more* cable. For example, *one* 24″ wide section of Wireway can support *as much cable* as sixteen lengths of 4″ conduit. That adds up to substantial savings on any size job.

• COSTS LESS TO INSTALL

Wireway is an integrated system designed to fit the most complex layout requirements. Light in weight and easy to handle, it is supplied ready to go . . . complete with necessary straight sections, fittings and accessories. All components are quickly inter-connected by means of Cope's unique pin-type coupler—thus reducing labor time and costs.

• COSTS LESS TO MAINTAIN AND EXPAND

Easy-to-get-at Cope Wireway simplifies cable inspection and repair. Re-routing provides no problem and additional cable can be readily laid in the existing system . . . if later expansion is required. Thus Cope's built-in expansibility assures *future* savings as well.

Consider these advantages of Cope Wireway. Then let an authorized Cope Electrical Wholesaler prove how a Cope cable supporting system can save money in your plant.

ALL COPE CABLE SUPPORTING SYSTEMS ARE AVAILABLE IN ALUMINUM OR HOT DIP GALVANIZED STEEL

1105

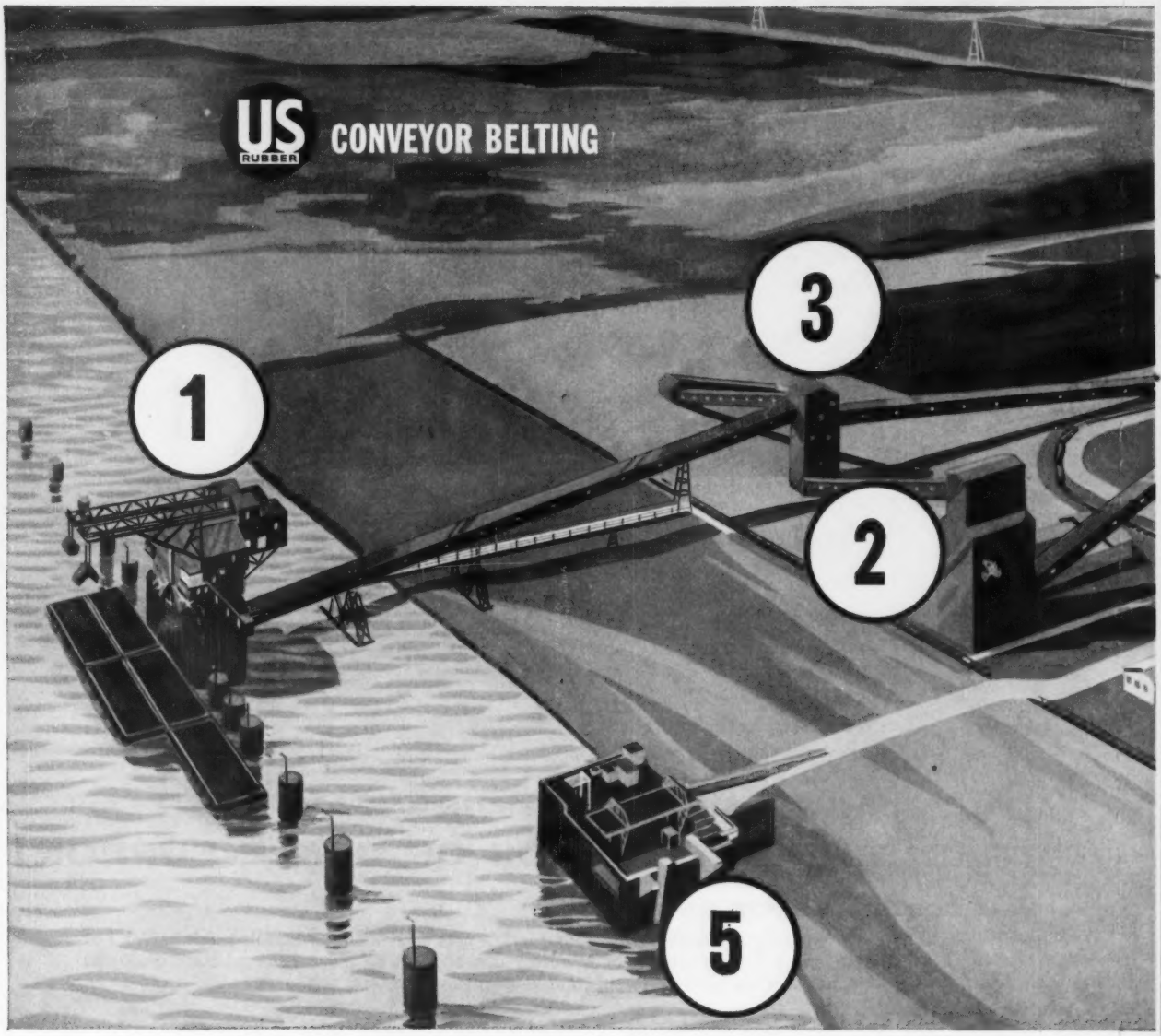
COPE

Originators of First Integrated Line of Cable Supporting Systems

WIREWAY • LADDER • CHANNEL • CONTROLWAY

Sold only through authorized electrical wholesalers

DIVISION OF ROME CABLE CORPORATION • COLLEGEVILLE, PENNSYLVANIA



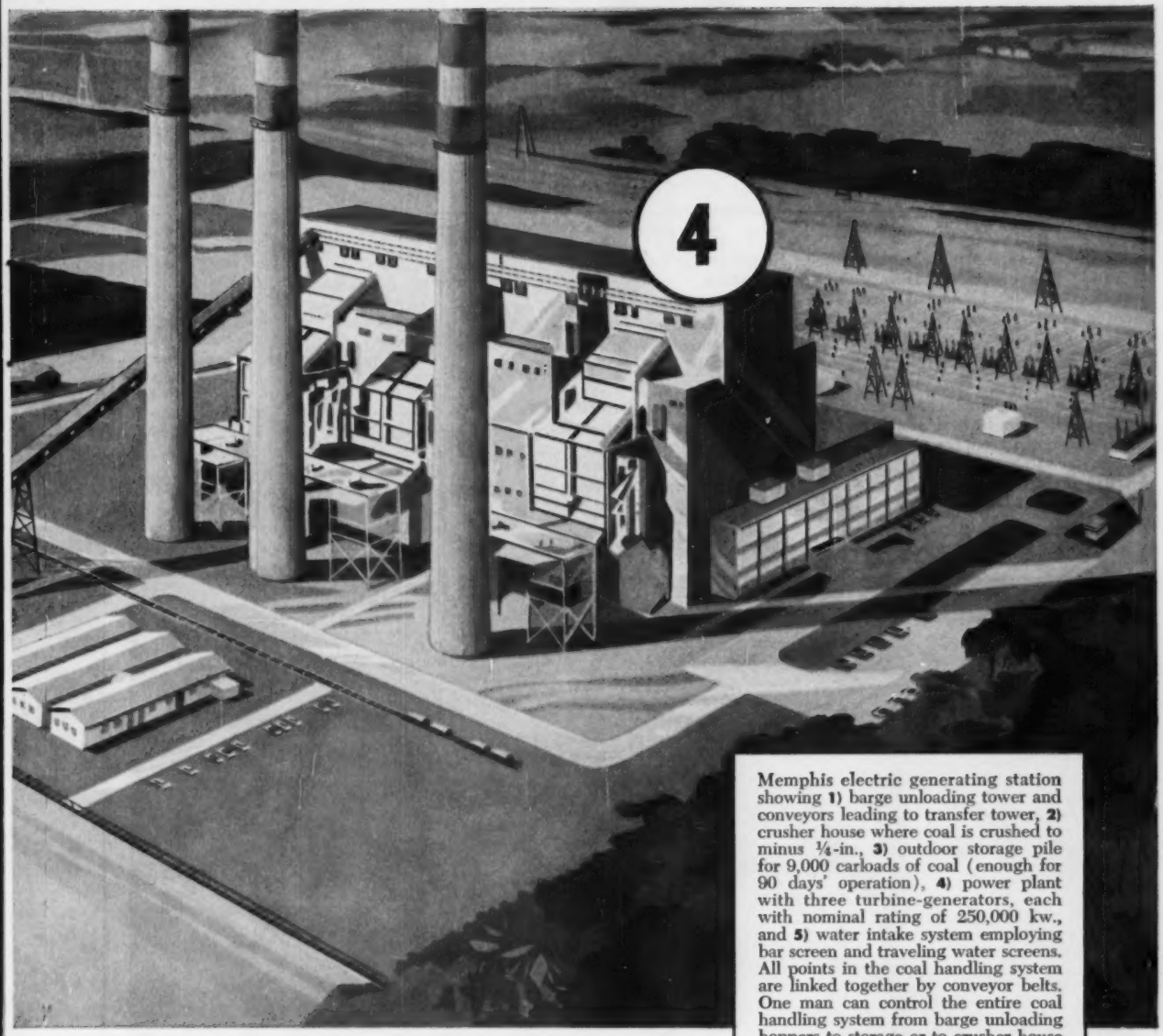
2,200 TONS OF COAL PER HOUR...all

The City of Memphis (Light, Gas & Water Division) operates the largest single steam power plant built to date for a municipality.

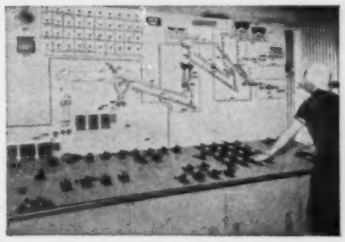
Link-Belt Company built and installed the mechanical conveyor system that conveys coal *from barge to transfer house, from transfer house to storage and from transfer house to crusher to bunkers.* U.S. Rubber constructed and furnished all belts conveying coal from transfer tower to the main power plant. Six conveyors in all are equipped with U.S. Conveyor Belts, including two 48"-wide U.S. Giant® Belts.

This extensive system is all controlled by one man operating the control panel in the transfer house.

The troughability and the training of the U.S. Rubber Belts result in efficient, economical operation, long life and freedom from maintenance. "U.S." Belts have long been noted for having these qualities. The inclusion of "U.S." Belts for this massive power plant is just one more unequalled instance that has made



Memphis electric generating station showing **1)** barge unloading tower and conveyors leading to transfer tower, **2)** crusher house where coal is crushed to minus ¼-in., **3)** outdoor storage pile for 9,000 carloads of coal (enough for 90 days' operation), **4)** power plant with three turbine-generators, each with nominal rating of 250,000 kw., and **5)** water intake system employing bar screen and traveling water screens. All points in the coal handling system are linked together by conveyor belts. One man can control the entire coal handling system from barge unloading hoppers to storage or to crusher house and bunkers. Lights and schematic diagram show portion of system in operation at any time.



controlled by one man

U.S. Rubber the foremost authority in the design, manufacture and installation of conveyor belts.

Get the advantages of "U.S." Engineering. "U.S." Engineers work directly with "U.S." Distributors or original equipment manufacturers to assure their obtaining the right belt for each type of conveying.

• • •

The most extensive belting engineering information in industry is available through your "U.S." Distributor. It will pay you to check with him.

US RUBBER

Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

Gas turbines show their breeding

BROWN BOVERI

By R. L. Steer, Project Engineer, Brown Boveri Corp.

Brown Boveri gas turbines have the "solid" look of steam turbines. The casings are machined castings. The rotor shafts are large. Bearings and other parts are easily accessible. Each turbine has a single, rugged combustion chamber.

This family resemblance comes naturally. Brown Boveri gas turbines were designed from the start for continuous stationary service . . . in contrast to lightweight units adapted from aircraft engine designs.

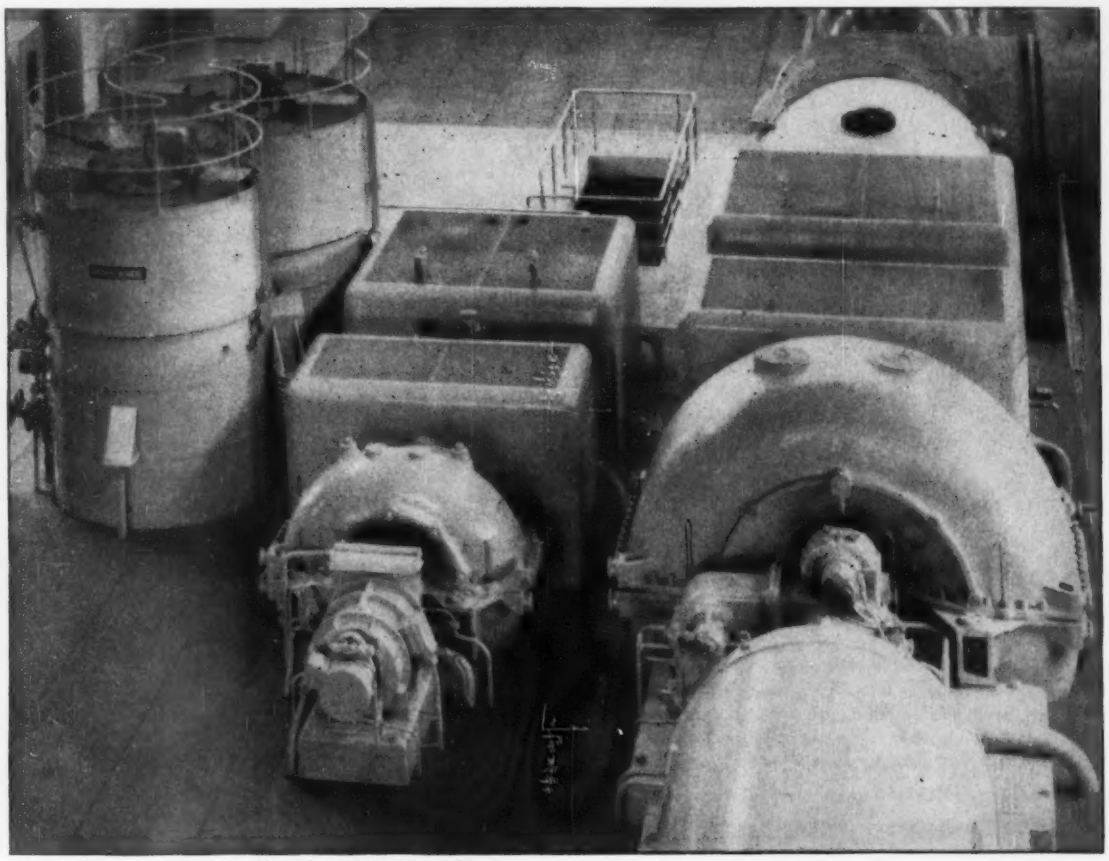
The first large gas turbine-generator, a 4,000 kw unit, was built by Brown Boveri and installed in 1939. It is still operating.

The world's largest gas turbine generating plant at Port Mann, Canada, is unattended! Its four 25mw Brown Boveri units are fully automatic and remote controlled.

Overhaul of two Brown Boveri gas turbine sets at the Pertigalete Cement Works, Venezuela, showed a typical condition: after 15,000 operating hours, components were almost like new. No sign of wear. No repairs or parts changes required.

Scores of Brown Boveri stationary gas turbines totalling over 1,300,000 kw installed capacity are driving generators, compressors and blowers in nearly continuous trouble-free operation—year after year. No other manufacturer can match this experience.

About Brown Boveri gas turbines: Sizes: 1,200 to 30,000 kw output. Single shaft sets for low initial cost. Double shaft, multi-stage units for lowest cost per kw and higher efficiency. Dual burners, quickly adaptable to gas or liquid fuels. Stationary, semi-mobile or mobile mounts. Completely automatic or remote controls.



A Brown Boveri two-stage gas turbine. This turbine drives a 25 mw generator part of which is visible at the lower right corner of the photo. Starting time from cold to full load is less than 20 minutes.

BROWN BOVERI Brown Boveri Corp., Dept. EW5, 19 Rector Street, New York 6, N. Y. Agents in 27 U. S. cities.

A-B QUALITY

NOTICE!

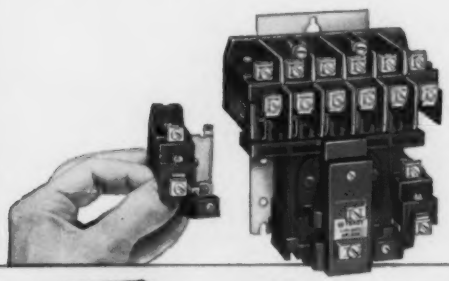
60 Second Contact Convertibility

ALLEN-BRADLEY CONTROL RELAYS

can thus easily be changed
from N.O. to N.C. (or vice versa)

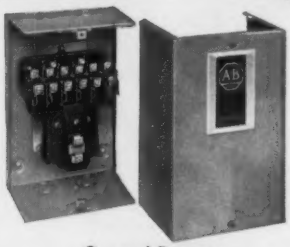
Why not give yourself a real surprise! We refer to the ease with which you can convert the contacts of these Allen-Bradley Bulletin 700 Type BR control relays. Using only a screwdriver, contacts can be changed from normally open to normally closed (or vice versa) in seconds—without removing the relay from its mounting—or its wiring. This "on-the-spot" convertibility certainly suggests an appreciable moneysaving reduction in your relay inventories.

Extensive tests have proven conclusively that the Bulletin 700 Type BR relays are good for many—and we mean *many*—millions of trouble free operations. A "built-in" permanent air gap completely eliminates all possibility of magnetic sticking. Naturally, the double break, silver contacts never need attention. Also, the molded coil is your assurance that even the most severe atmospheric conditions cannot cause trouble. Please write for full details on these relays today!



BUT HEAR THIS!

In the event that when "on-the-job" it is discovered that something was either overlooked or added, the standard Bulletin 700 Type BR—either 2, 4, or 6 pole relay—can easily have added to its base, out in the field, either one or two switching poles. It is done as easily as "falling off a log."



General-Purpose
NEMA 1

Explosion-proof
NEMA 7

Waterproof
NEMA 4

FIVE RELAYS IN ONE
This shows how a Type BR relay can be arranged —in seconds—to do the job of five different relays.
3 N.C.—1 N.O.
3 N.O.—1 N.C.
4 N.C.
2 N.O.—2 N.C.
4 N.O.

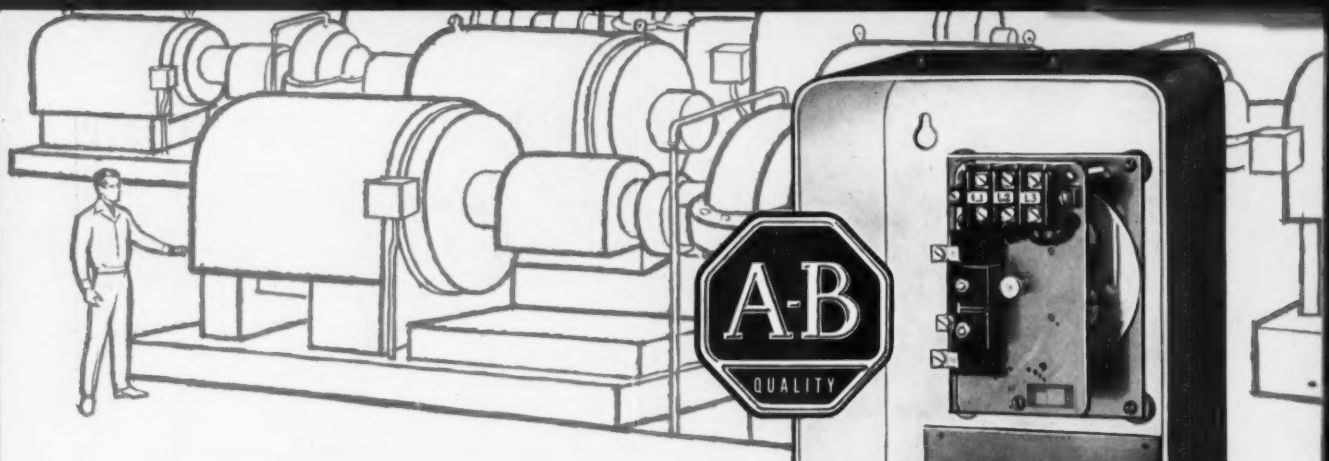
8-60-RM

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. · In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL



ALLEN-BRADLEY PHASE FAILURE and PHASE REVERSAL RELAYS

will provide positive protection for high-horsepower, high-priced motors!

It's sound "economy" to guard your investment in expensive motors and equipment against the extensive damage that can result from a phase failure or phase reversal. Allen-Bradley's Bulletin 812 Style RF relay provides *complete, positive* protection against both of these hazards.

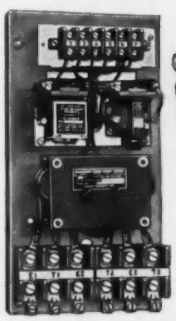
The Bulletin 812 Style F phase failure relay instantly detects *all* open phase conditions on a motor branch circuit and removes the motor from the line—yet is not subject to nuisance dropouts from transient line fluctuations. An unusual feature of this Style F relay is its positive response, regardless of motor load or type of motor branch circuit employed.

The Bulletin 812 Style R phase reversal relay disconnects the motor from the line—whether it is running or not—when a phase reversal occurs on the line side of the relay. Thus, it can be used to protect a single motor or a group of motors. Furthermore, the Style R relay removes the motor from the line should a phase failure occur while the motor is stopped.

All A-B Bulletin 812 relays are completely "fail safe." It will pay you to investigate this economical insurance against the heavy losses that can—and *frequently* do—result from phase failure and phase reversal. Write today!

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

Bulletin 812 Style RF for Phase Failure and Phase Reversal consists of Style F Phase Failure and Style R Phase Reversal relays in the same enclosure.



Bulletin 812 Style F for Phase Failure

Bulletin 812 Style R for Phase Reversal

B-65-RH

ALLEN-BRADLEY

Member of NEMA

Quality Motor Control

NOMINAL WEIGHTS OF FINISHED WEATHER-RESISTANT WIRE AND CABLE

(Pounds per 1000 Feet)

Conductor Size AWG or Mcm	Copper & Copper Alloy Conductors: URC Type Double Braid	URC Type Triple Braid	Neoprene Type	Polyethylene Type	Aluminum Conductors: Neoprene Type	Polyethylene Type
Stranded						
2	246	270	248	**230**	105	**87.4**
4	155	170	163	**143**	73.3	**53.3**
6	103	115	108	**91.5**	51.5	**35.0**
Solid						
2	239	260	232	**219**	92.2	**79.2**
4	151	164	152	**136**	64.0	**48.0**
6	100	112	101	**87**	45.7	**31.7**

Sources: American Standards Association Specifications

This table shows

POLYETHYLENE covered line wire weighs less

Because it's the lightest, polyethylene-covered line wire is the easiest for linemen to string up . . . hardest for ice and snow loading, gale-force winds to bring down.

Polyethylene-covered line wire, depending on size and conductor, weighs from 5% to 32% less than other types. That's what the figures in the specifications tabulated above show.

This, of course, is no news to linemen who have strung all types of weatherproof line wire. They may not be able to quote pounds and percentages, but they all know you can't beat polyethylene on weight.

Linemen's Favorite Material

Light weight means easy handling, one of the main reasons polyethylene rates tops with installation crews. They also like polyethylene wire because it's clean . . . free-stripping . . . has a smooth, self-lubricating surface that almost makes pulling a pleasure. And despite the exterior slip, the plastic covering hugs the conductor tightly, doesn't ruffle as it goes over crossarms.

"Built-in" Safety Factor

Polyethylene's lightness provides lasting mechanical advantages, since span loads don't tax supports as much as heavier type wire. This "built-in" weight safety factor pays off when violent storms push aerial construction to strain limits . . . when ice and snow loads topple heavier lines.

An added factor in polyethylene wire's ability to stay up under adverse conditions is its smaller diameter. It offers less resistance to wind, a smaller surface for ice build-up.

Winning Combination

Called the "closest to the ideal covering for line wire," polyethylene is outstanding in other respects too. The shield it forms over wire is continuous . . . tough . . . resistant to aging, weathering, moisture, abrasion by lashing branches. It's good for decades of superior service marked by fewer outages, minimum maintenance.

When you order covered wire and cable, make sure the coating is made with PETROTHENE® polyethylene resins. PETROTHENE polyethylene costs no more, but it gives you premium weather and stress-crack resistance.

Polyethylene's advantages are outlined in an informative new U.S.I. data sheet, "Polyethylene . . . The Best Line Wire Covering." Also available is a data sheet showing properties, applications and specifications of PETROTHENE polyethylene compounds. Send for your copies today.

U. S. Industrial Chemicals Co.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.

Please send me:
- ☐ "Polyethylene . . . The Best Line Wire Covering"
- ☐ "PETROTHENE Resins for the Wire and Cable Industry"

Name:_____ Title:_____

Company:_____

Address:_____

City:_____ State:_____

USI INDUSTRIAL CHEMICALS CO
Division of National Distillers and Chemical Corp.
99 Park Ave., New York, 16, N. Y.
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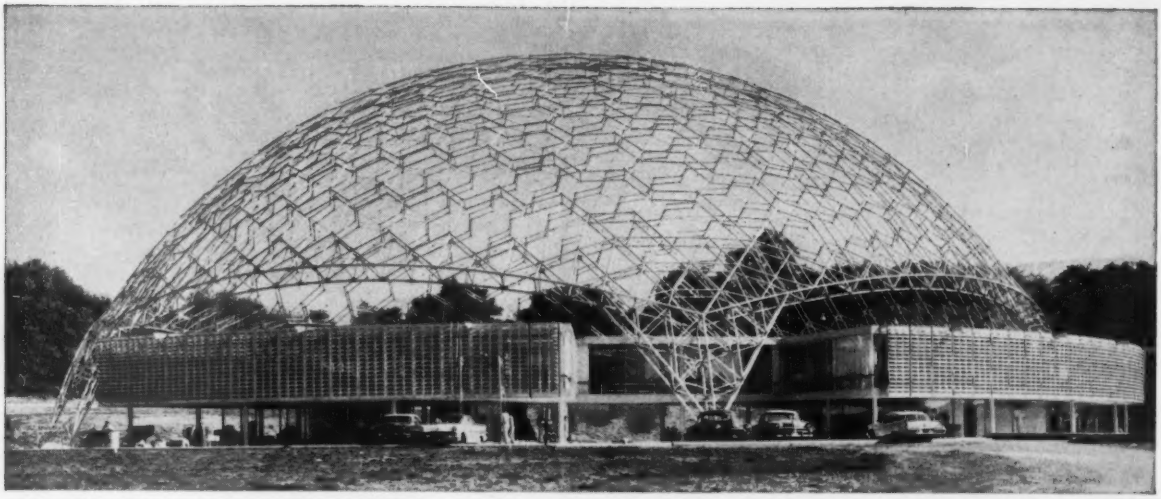
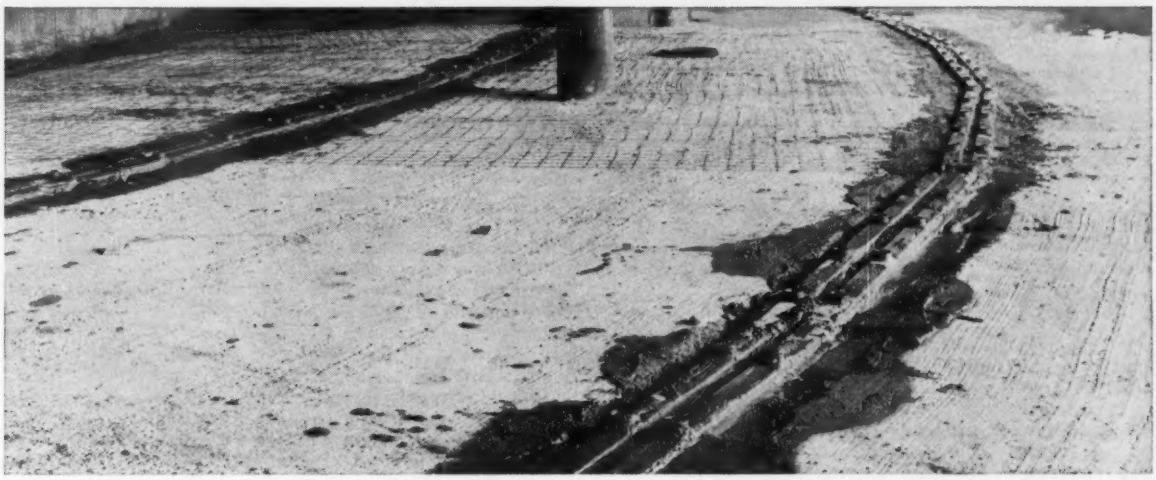


Ultramodern ASM headquarters at Metals Park, Novelty, Ohio demonstrates geodesic dome construction. *Architects:* John Terence Kelly, Cleveland, Ohio; *General Contractor-Engineering:* Gillmore-Olson Co., Cleveland, Ohio; *Electrical Engineers* (Plans & Specifications): John Paul Jones, Cary & Millar, Cleveland, Ohio; *Electrical Sub-Contractor:* Doan Electric Co., Cleveland, Ohio.

Nepcoduct fits the job perfectly at ASM's New Geodesic Dome Headquarters



Continuous curve of building posed unusual problem in installing underfloor raceways.

To provide complete electrical flexibility, underfloor raceways were specified for American Society for Metals' ultramodern National Headquarters building at Novelty, Ohio. But they had to conform to the continuous curve of the semi-circular building. "Nepcoduct" fit the job perfectly without the use of elbows or special fittings—which meant economical installation. National Electric's "Nepcoduct" Underfloor Raceway was the up-to-the-minute answer to a very new problem in electrical construction.

"Nepcoduct" Underfloor Raceways are but one of a complete line of modern underfloor and surface electrical distribution systems available from National Electric. For complete details, write to *National Electric Division, H. K. Porter Company, Inc., Porter Building, Pittsburgh 19, Pa.*

NATIONAL ELECTRIC DIVISION PORTER **H. K. PORTER COMPANY, INC.**

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

LOWEST-COST TRANSMISSION LINE

Armless pole design eliminates crossarms, braces, hardware . . . saves up to one-third in material . . . more in labor of erection. Because insulator is stronger than crossarm, permits longer spans, larger conductors, greater safety margins. Requires narrowest ROW. Easiest-ever for hot-line work.

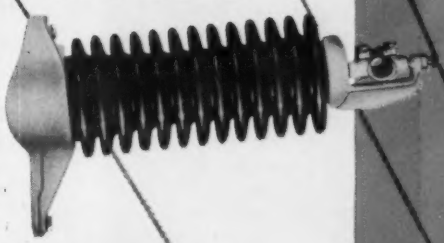
BEST-PERFORMING TRANSMISSION LINE

Horizontal mounting of Line Post encourages uniform wetting and self cleaning, improves wet flashover values by as much as 15% over upright ratings. Eliminates contamination flashover and pole-top burning.

BEST-LOOKING TRANSMISSION LINE

Neat, unobtrusive appearance avoids customer objection in urban and suburban residential construction. Can handle 69 kv, or higher, yet looks more like a "small" distribution line. Permanently free of RIV and TV interference, too.

the insulator for armless transmission



Lapp Line Posts with clamp-top and integral-base-and-gain for horizontal mounting are available in voltage ratings of 35 kv, 45 kv, 55 kv, 66 kv and 88 kv. Each insulator is held by two through-bolts, and entire structure is easily assembled on the ground before erection.

Lapp

Modern armless construction with Lapp Line Posts is explained in detail in the new Lapp Catalog No. 8. Write for your copy.
Lapp Insulator Co., Inc., LeRoy, N. Y.

NEW UTILITY STATIONS, C-E EQUIPPED

Includes only new stations on *new* sites placed in operation since JANUARY 1, 1950.

LAKE CATHERINE
HUTCHISON
YATES
DUNKIRK
TITUS
LEE
CONTRA COSTA
HAWTHORN
NINEMILE POINT
EDGE MOOR
PALATKA
JOHNSONVILLE
DANSKAMMER
BECKJORD
HIGHGROVE
PLANT X
BLACK DOG
ALBANY
JOPPA
MERAMEC
PORTSMOUTH
LAKE CREEK
ETIWANDA
AURORA
HENNEPIN
EASTLAKE
OAK CREEK
SUWANNEE RIVER
URQUHART
KINGSTON
SANDOW
MULLERGREN
BARRY
NORTH OMAHA
WILMINGTON
CARBON
SAGUARO
MORRO BAY
VERMILION
JOHN SEVIER
COLLIN
MILLIKEN
GALLATIN
BARRETT
MITCHELL
SAN BERNARDINO
YORKTOWN
GULF COAST
TUCSON
PORT WENTWORTH
W. A. PARISH
ALLEN
MONTROSE
McMEEKIN
LEWIS and CLARK
ROY S. NELSON
YUMA AXIS
DICKERSON
DAN E. KARN
WILLOW GLEN

OCOTILLO

NEW OCOTILLO POWER PLANT

Goes into Service

The Arizona Public Service Company has recently placed in service Units No. 1 and No. 2 at its new Ocotillo Steam-Electric Generating Plant. Each of these units is rated at 110,000 kw capacity and a third of the same size is planned for later service. Located in the city of Tempe, eleven miles east of Phoenix, this modern, outdoor plant was planned and erected by Ebasco Services Inc.

Plant and operating costs are expected to be materially reduced by designing the station for the operation of all units from one central control room.

Steam for the two turbine-generators, now in service, is supplied by C-E Steam Generating Units of the radiant, reheat design. A cross-sectional elevation and brief description of these units appears on the opposite page.

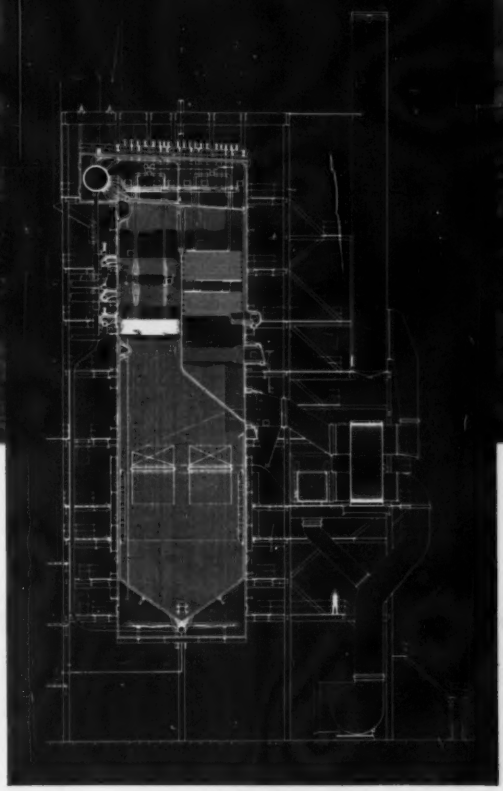
COMBUSTION ENGINEERING

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

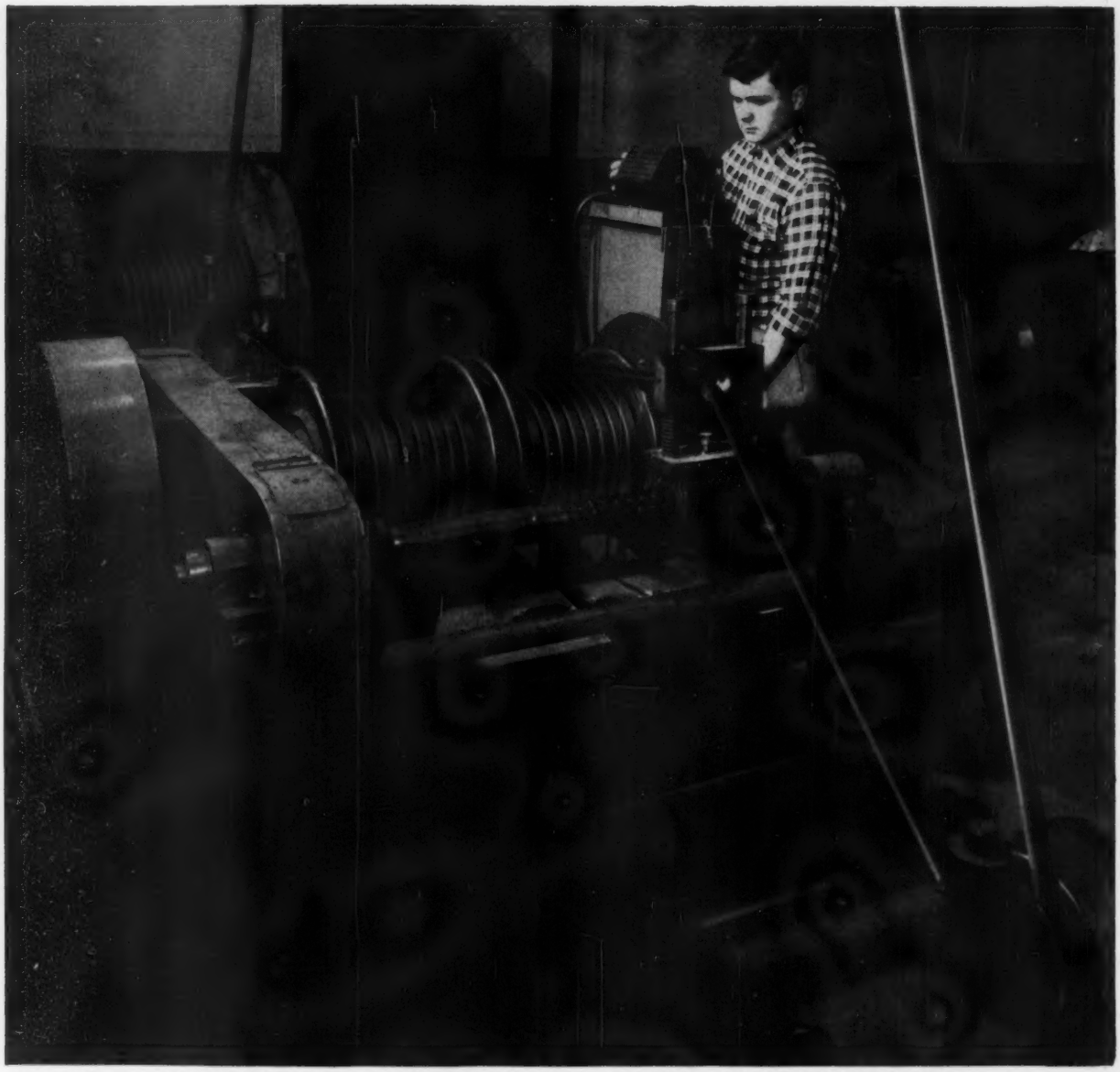
C-E

C-276

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT;



The C-E Unit shown here is one of two duplicate units now in service at the Ocotillo Plant. It is a radiant, reheat boiler with pressurized furnace. The reheater surface is located in the first pass of the boiler above the secondary superheater section. Primary superheater surface is in the rear boiler pass and economizer surface is located directly below the primary superheater. Regenerative air heaters follow the economizer section. The boiler is arranged for gas or oil firing using tilting, tangential burners. The design will permit changing to future coal firing if desired.



Accelerated testing of cable. This machine, designed by AS&W engineers, is testing mining machine cable to determine its resistance to reeling and pay off under tension, abrasion, flexing under tension, kinking under tension. Just one of the ways to determine the best insulating and jacketing compounds.

From portable tools to the largest power shovels, Amerclad Cables offer safe dependable service.
It's how you mix ingredients in just the right proportions that makes a big difference in cable performance.

USS **Tiger Brand Electrical Wire & Cable**

A standard cable for every special job

- Asbestos Wire and Cable
- Mold-Cured Portable Cord
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

What's the difference in electrical cable?

In (USS) Tiger Brand Amerclad it's better engineering and quality construction

Engineered for the job. USS Tiger Brand Amerclad Cables are used in such a variety of applications that "engineering for the job" becomes extremely important. Special constructions are designed for electric shovels, dredges, mining machines, welders and portable tools. Cable life depends on how well the engineers have anticipated all the destructive forces that a cable encounters in service.

Quality construction. USS Amerclad's highly flexible construction—rubber insulated conductors and Amerprene jacket—is carefully designed to give you superior electrical performance and mechanical reliability. Dynamically balanced rope lay conductors, as opposed to loosely bunched groups of fine wires, give balanced performance and long, trouble-free service through elimination of unequal tension and elongation.

Each conductor is separately insulated with Amerite, a tough heat-resisting, special rubber compound that exceeds the requirements of ASTM, and other industry standards. A rugged abrasion resisting Amerprene jacket protects the cable from mechanical abuse.

Tiger Brand Amerclad Cables are as tough as they come. They soak up shock and vibration, withstand crushing impact, severe jerking and pulling for unbelievably long periods. Used outdoors for mining, quarrying and excavating machines, Amerclad resists the constant wear and abuse from contact with rocky ground. And installed on lighter indoor equipment—electric welders, shop tools and motor leads—Amerclad gives top performance even when it's dragged over rough floors, through oil, grease or water.

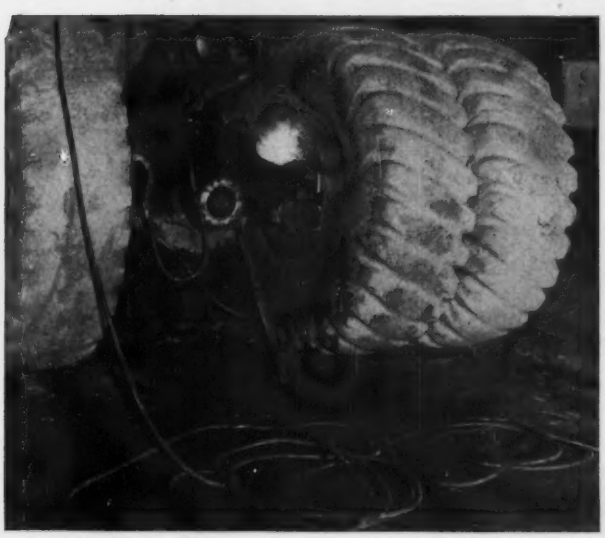
Amerclad's greater durability will pay for itself many times in unfailing service, and ability to handle rated loads. It's the toughest electrical cord and cable money can buy.

Send for catalog. The Tiger Brand Amerclad Cable story is told completely in our new book we've reserved for you. We'll send the book without cost or obligation. American Steel & Wire, Dept. 0196, 614 Superior Avenue, N.W., Cleveland 13, Ohio.

USS, Amerclad, Amerite, Amerprene and Tiger Brand are registered trademarks

(USS) **American Steel & Wire Division of United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad



FOR AUTOMATIC CONTROL OF STEAM STATIONS

An RW-300 system in a steam station can pay for itself by improving service continuity, increasing safety for personnel and equipment, and reducing operating and maintenance costs. RW-300 computer control can reduce the probability of major accidents, decrease the number of outages, and ensure faster return to service following an outage. In addition, through monitoring plant performance and computing heat rate, computer control can provide significant fuel savings.

Many utility leaders are now considering computer control of boiler-turbine-generator units, and uppermost in their minds is the question of system reliability. Field reliability can be proven only by on-line systems standing up under continuous service in rugged industrial environments. Every day more than a dozen RW-300 systems are operating around the clock in a variety of industries.

For further information, call or write Mr. Raymond E. Jacobson, Director of Marketing, Dept. EW-1077-3.

RW-300

the most field-reliable computer control system . . .

THE THOMPSON-RAMO-WOOLDRIDGE PRODUCTS COMPANY

a division of ***Thompson Ramo Wooldridge Inc.***

202 NORTH CANON DRIVE • BEVERLY HILLS, CALIFORNIA • BRADSHAW 2-8892

NEW BULLDOG XL BUSTRIBUTION DUCT...

3 WAYS SAFER FOR PEOPLE AND PROPERTY

HERE'S THE FIRST DEAD-FRONT plug-in duct. Butyl insulation covers the full length of each silvered aluminum bus bar, *even in bus plug openings.* You get positive protection for personnel against accidental contact with "live" bars.

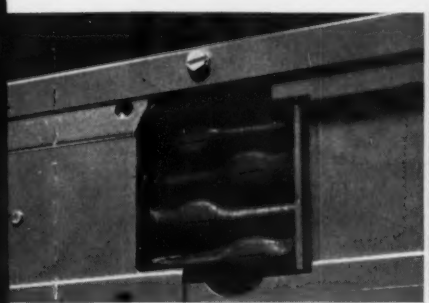
PLUG-IN SAFETY DOOR IS ALWAYS CLOSED during installation of XL Safety Plug. Interlock finger positively prevents plug installation or removal when Safety Door is open . . . and it keeps door from closing against "live" plug fingers.

THERE'S NO ARCING to endanger people or property . . . you can't plug in or unplug when the switch is "ON."

New XL BUStribution® Duct cuts down installation time . . . takes less space . . . reduces duct weight on building structure as much as 40%. Keyed bus ends slip together in a hurry while a single integral bolt locks joints securely under a ton of pressure.

Ask your BullDog field engineer to arrange for a demonstration. You'll quickly see the sales appeal of XL BUStribution Duct and matching Safety Plugs.

BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Michigan. In Canada: 80 Clayson Rd., Toronto, Ont. Export Division: 13 East 40th St., New York 16, N. Y.



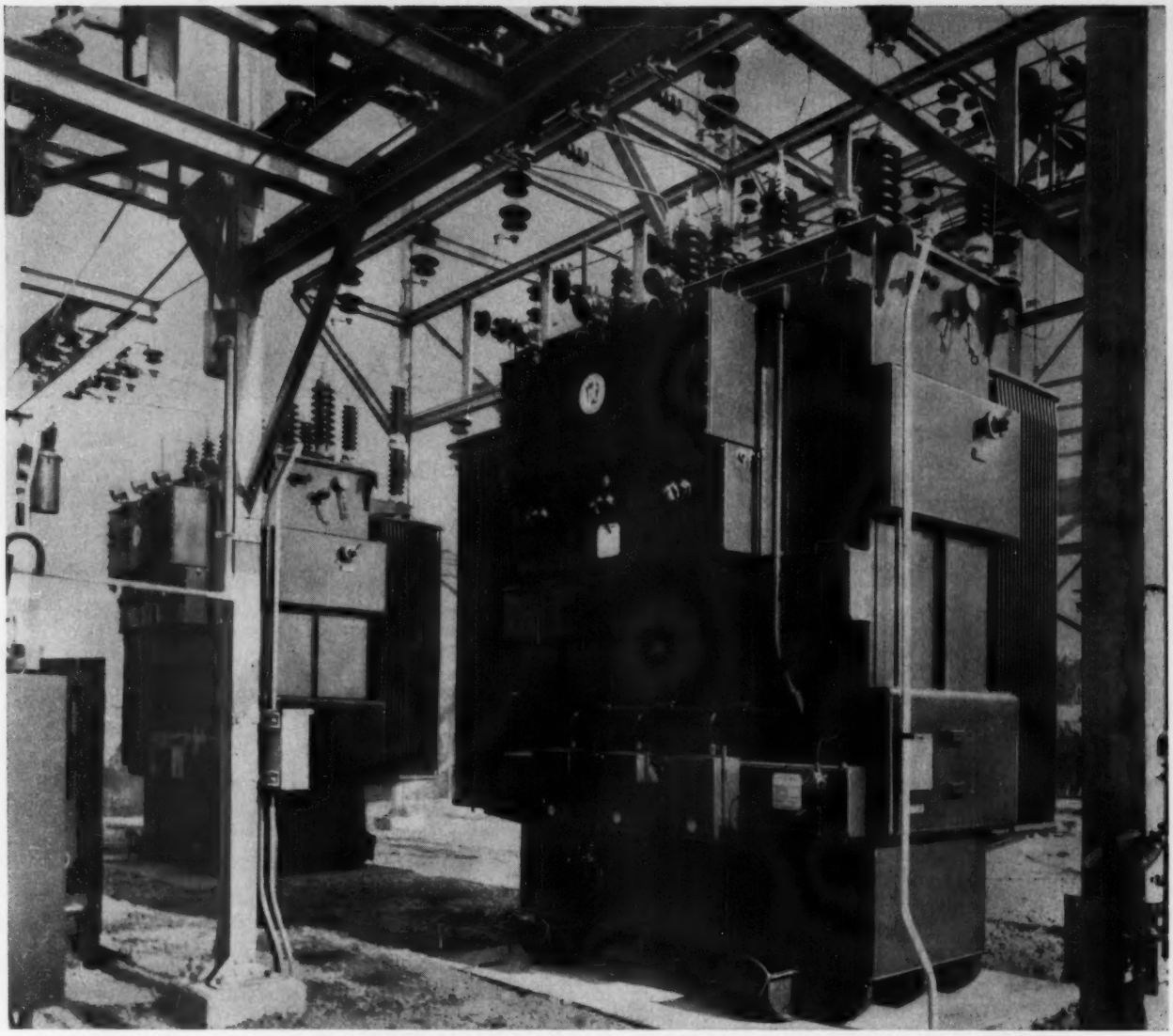
IT'S TRUE DEAD-FRONT. Each silvered aluminum bus bar is full-length insulated with Butyl envelope.

IT'S A SAFETY DOOR. You can't plug in or unplug with the door open, can't close door on "live" plug fingers.

IT'S A SAFETY PLUG. You can't plug in or unplug against a load . . . safeguards personnel and equipment against arcing.

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY

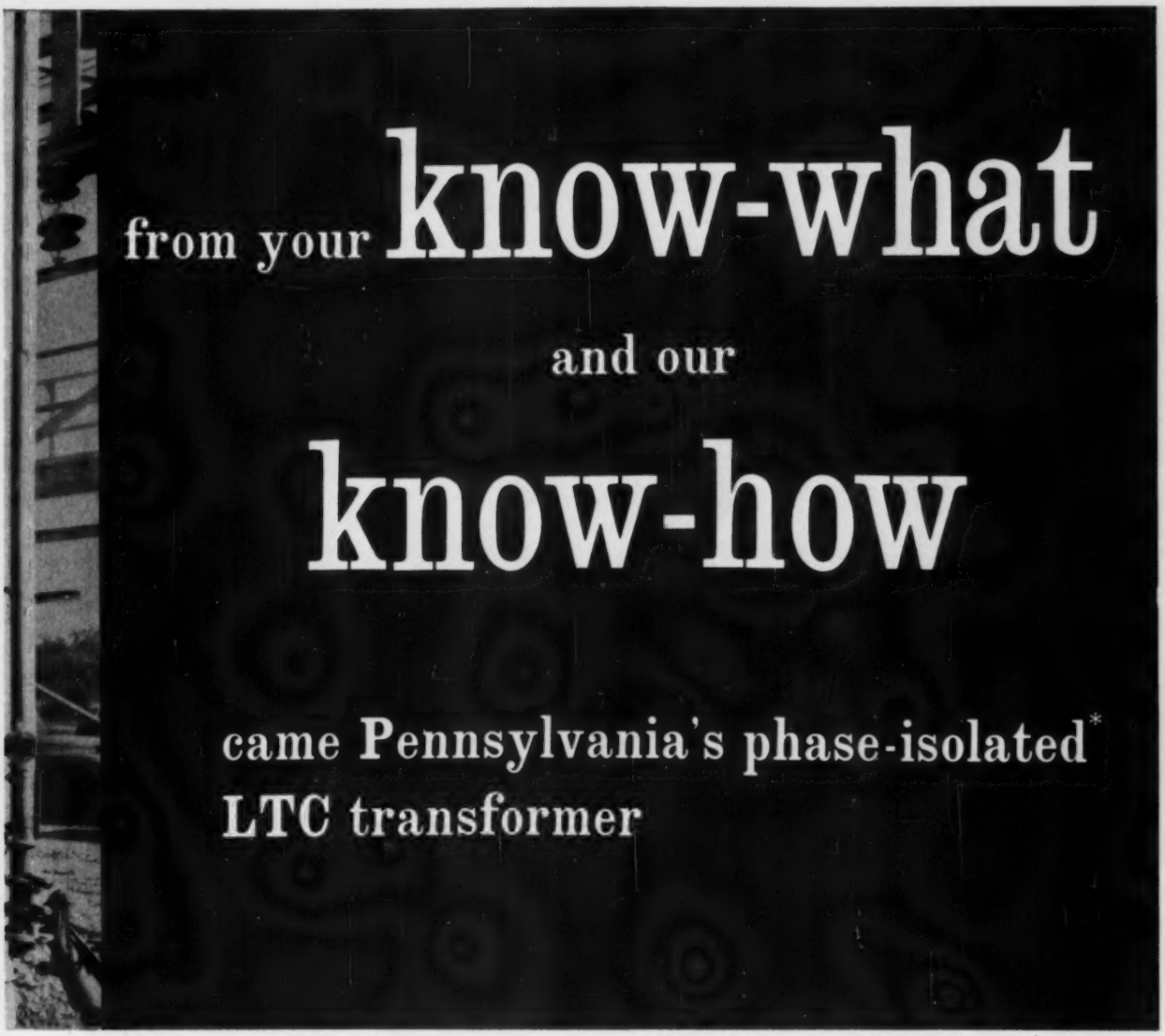
KEEP PACE ELECTRICALLY



Phase-Isolated LTC transformers rated 7500 kva, 67000△-13090Y/7560 volts with 20% regulation in 32 full-capacity steps-16 above and 16 below. The units have provision for future FA cooling to increase the rating to 9375 kva and are equipped for parallel operation.

Pennsylvania Phase-Isolated Three-Phase Transformers with range of 20% regulation in 32 steps are available in the following kva and voltage ratings:		
BIL	**LOW VOLTAGE**	**KVA**
75 kv	4160Y/2400 or 4360Y/2520 volts	1000 kva thru 2500/3125 kva incl.
95 kv	8320Y/4800 or 8720Y/5040 volts	1000 kva thru 5000/6250 kva incl.
110 kv	12470Y/7200 or 13090Y/7560 or 13200Y/7620 or 13800Y/7980 volts	1000 kva thru 7500/9375 kva incl.
Note: Other voltage and kva ratings can be secured under special conditions.		

PENNSYLVANIA PHASE-ISOLATED



From a broad survey, made among utility engineers and operating people, we found that two worthwhile features were lacking from conventional 3-phase LTC transformers used for supplying distribution system loads. Independent single-phase regulation was one, and by-pass facilities for the LTC switches and mechanisms was the other.

Single-Phase Regulation

With single-phase regulation of 3-phase transformers, voltage extremes can be held to narrower limits. Consequently, feeder loading can be increased without exceeding established voltage limits. This appreciably reduces expenditures for expansion. When voltage limits are reduced, the average voltage can be increased, producing substantially more revenue from voltage-sensitive loads.

LTC By-pass Switches

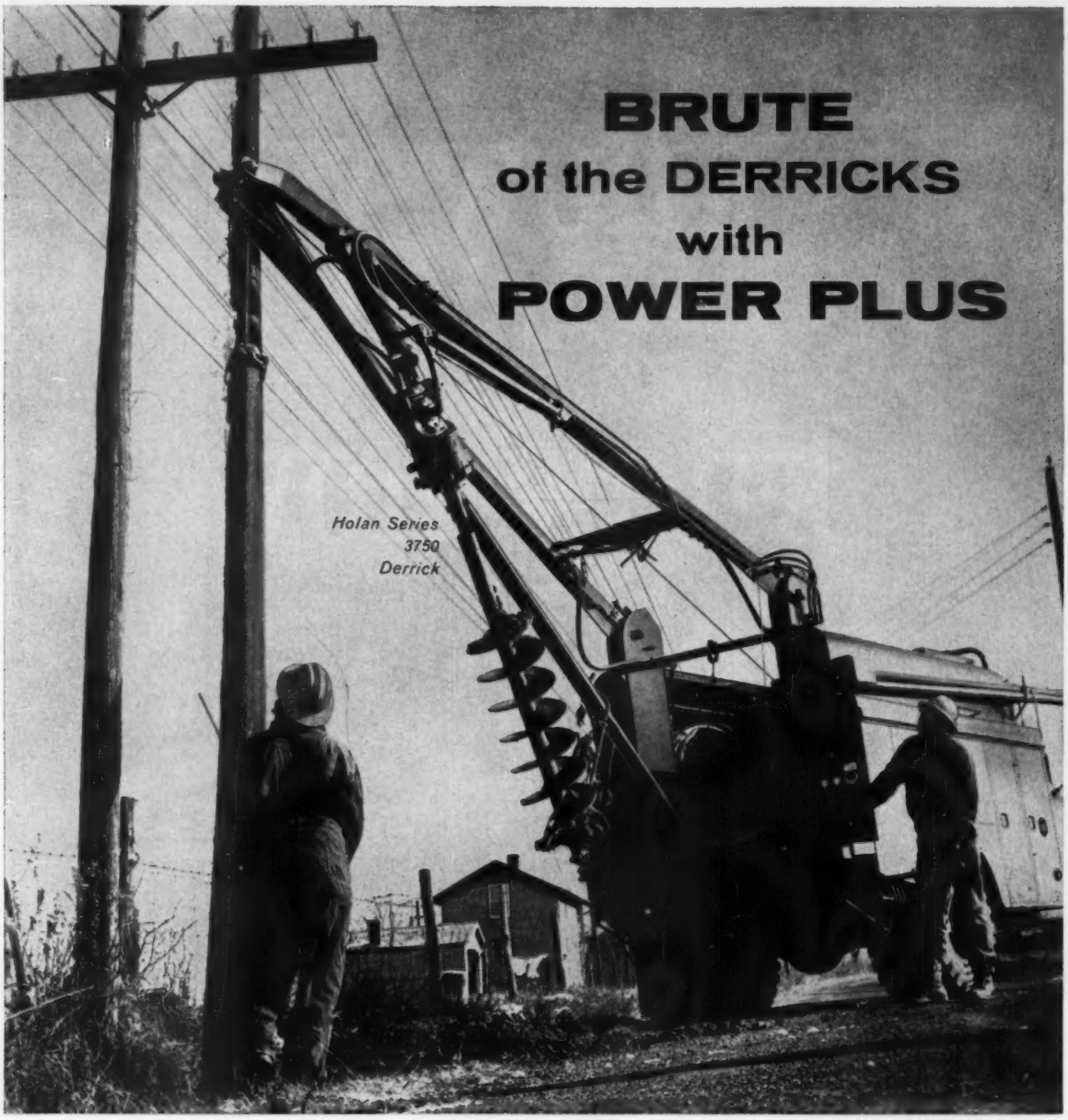
Conventional 3-phase LTC transformers must be entirely de-energized in order to inspect or maintain the contacts and mechanism. Integral by-pass facilities permit this equipment to be safely serviced phase-by-phase, without de-energizing the circuit. The work can be done according to a convenient schedule, at a lower cost.

Pennsylvania has incorporated these valuable features in the Phase-Isolated LTC transformer. The cost? . . . only slightly more than for an equivalent conventional LTC transformer. Compared with the installation of separate units—transformers, regulators and by-pass switches—the cost is considerably less.

When planning your next distribution substation addition, consider the advantages of a Pennsylvania Phase-Isolated LTC Transformer. Bulletin #591, containing further information, will be supplied on request. Write on your company letterhead to Power Sales Department, Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pennsylvania.

*Patent pending

THREE-PHASE TRANSFORMERS



It's been called "a brute of a derrick" by utility crews all over the country. That's because the new Holan Series 3750 Hydraulic Derrick with live boom is engineered to withstand abuse in the field.

And the 3750 has plenty of muscle. For the record, it has a 12,000-pound capacity, but it has actually been tested at 22,000 pounds.

An integral middle leg with live-boom action provides extra strength for butt-pulling, body loading and other heavy lifting assignments. The rectangular side legs are fabricated of long-lasting, rust-resisting high tensile steel.

Hoisting 5,000 pounds over the rear axle for body loading is a simple task for the 3750. And the 195° operating range makes it possible to lower the derrick to within five feet of the ground for easy threading of the winch line.

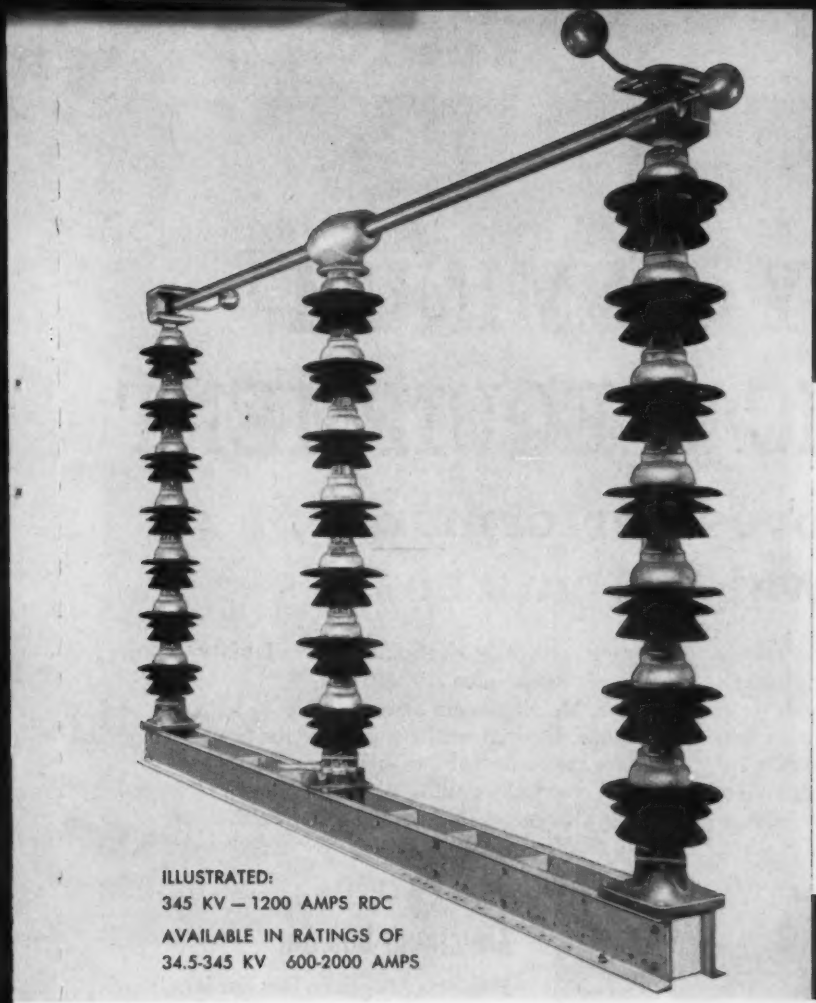
There's power to spare in the 3750—power for such tasks as forcing the Holan 5400 Multiple-Speed Digger shown here into hard and rocky soil. And the extra power makes it easy to remove an auger full of dirt.

Let us tell you more about this new Holan Derrick. Write us—or call your Holan Field Representative—for complete details.

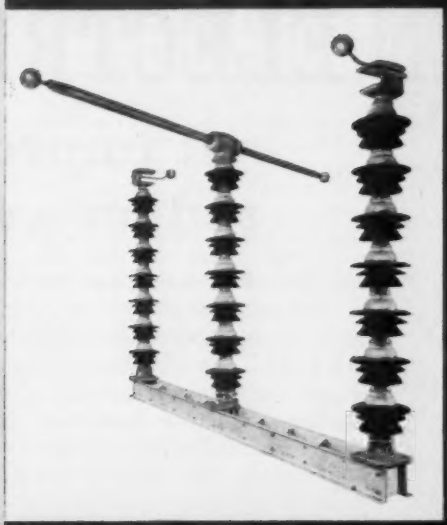
Holan Corporation, 4100 West 150th Street, Cleveland 35, Ohio
Plants in: Cleveland, Ohio; Griffin, Georgia; Phoenix, Arizona

Holan

Subsidiary of THE OHIO BRASS COMPANY



ILLUSTRATED:
345 KV — 1200 AMPS RDC
AVAILABLE IN RATINGS OF
34.5-345 KV 600-2000 AMPS



For Appearance, Low RIV, and Ease of Operation Choose Southern States RDC Side-Break Switch

Certain design characteristics count heavily in the selection of air switches.

Appearance is important, especially where the switch is to be part of a modern substation. The RDC is streamlined. It has no exposed cranks, arms, or clevises to mar its smooth contours.

Radio Influence Voltage is a strong factor, especially where the switch is in an urban area. The RDC's corona-resistant lines result in RIV of less than 500 microvolts.

Ease of operation is always a prime consideration. The RDC, with the weight of the blade balanced on the center insulator, operates with ease in any mounting position.

Other important characteristics of the RDC, to be considered in judging an air switch, are: Amplitact® contacts to provide maximum dependability under short circuit stress . . . resistance of exposed metal parts to corrosion . . . one-piece blade balanced in all positions . . . simplified installation . . . and quality construction throughout.

For complete details, see your Southern States representative, or write us direct for Technical Bulletin 58RDC.

LIVE BETTER ELECTRICALLY

IN CANADA:
Dominion Cutout Co., Ltd., Toronto

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

SPECIFY ALUMINUM IN ELECTRICAL EQUIPMENT

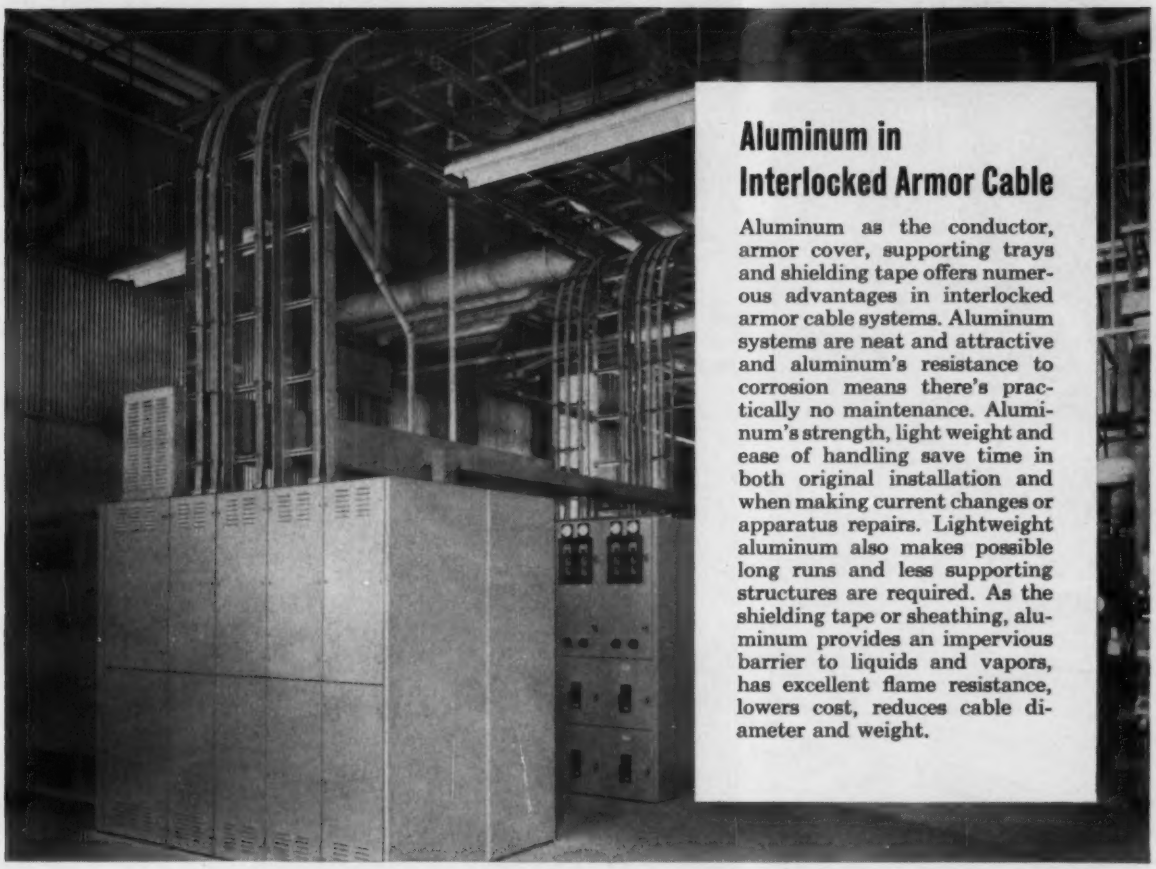
...it improves performance, reduces weight, cuts costs

Regardless of whether you purchase or manufacture electrical equipment, aluminum's unique combination of advantages can be of value to you. Some of these advantages are: low cost, minimum maintenance, easier installation, attractive appearance, high electrical conductivity, light weight, resistance to corrosion, high thermal conductivity, strength, ease of fabrication, good availability and high scrap value.

Reynolds Engineers are available to help translate these advantages into better products for the electrical industry. Contact your nearest Reynolds office or write *Reynolds Metals Company, P.O. Box 2346-EL, Richmond 18, Virginia.*

Aluminum Bus Bar

Reynolds Aluminum Bus Bar is available bare or silver plated and offers savings of 35 to 50% over bare or plated copper conductors. Standard extruded shapes and sizes are available from stock, and special shapes and sizes can be extruded in practically unlimited range. Silver Plated Bus Bar surfaces permit higher operating temperature with bolted joints and simplified soldering. It is ideal for applications in sub-stations, metal enclosed switchgear, power transformers, bus duct, panel boards, and other electrical equipment. In addition, aluminum bus bar is lightweight, easy to cut, bend and form—makes installations easier and faster and lower in cost.



Aluminum in Interlocked Armor Cable

Aluminum as the conductor, armor cover, supporting trays and shielding tape offers numerous advantages in interlocked armor cable systems. Aluminum systems are neat and attractive and aluminum's resistance to corrosion means there's practically no maintenance. Aluminum's strength, light weight and ease of handling save time in both original installation and when making current changes or apparatus repairs. Lightweight aluminum also makes possible long runs and less supporting structures are required. As the shielding tape or sheathing, aluminum provides an impervious barrier to liquids and vapors, has excellent flame resistance, lowers cost, reduces cable diameter and weight.

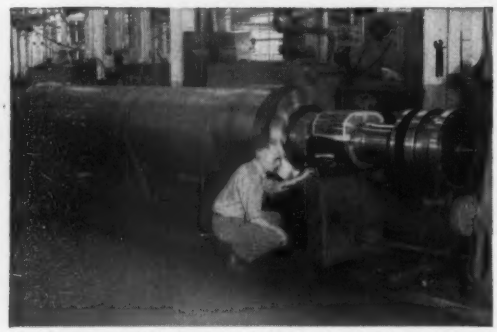
Aluminum Conduit

Reynolds Aluminum Rigid Conduit cuts both installation and maintenance costs. It weighs only one-third as much as conventional conduit—installation is faster, easier. Aluminum conduit resists corrosion from most industrial atmospheres. Aluminum conduit is also non-magnetic, longer runs and smaller conductors are often possible.

REYNOLDS ALUMINUM

Watch Reynolds TV Shows: "BOURBON STREET BEAT" and "ADVENTURES IN PARADISE"; and "ALL STAR GOLF" (resuming in October)—ABC-TV

Thermal cycling ruined it...



Rewound rotor is balanced at National's plant to less than .0005" motion in free floating bearings. After complete testing, rotor was returned to service.

National rebuilds 63,333-hp rotor to last

This rotor for a wind tunnel motor took unusual punishment. Since loading of the motor continually changed, the rotor was subjected to severe thermal cycling. Expansion and contraction of coils in the slots broke down the mica ground insulation.

National rewound the rotor with new coils insulated with glass-fiber and resin. New design slot troughs of high mechanical strength were used. Now the insulation wall is extremely tough, solid and durable.

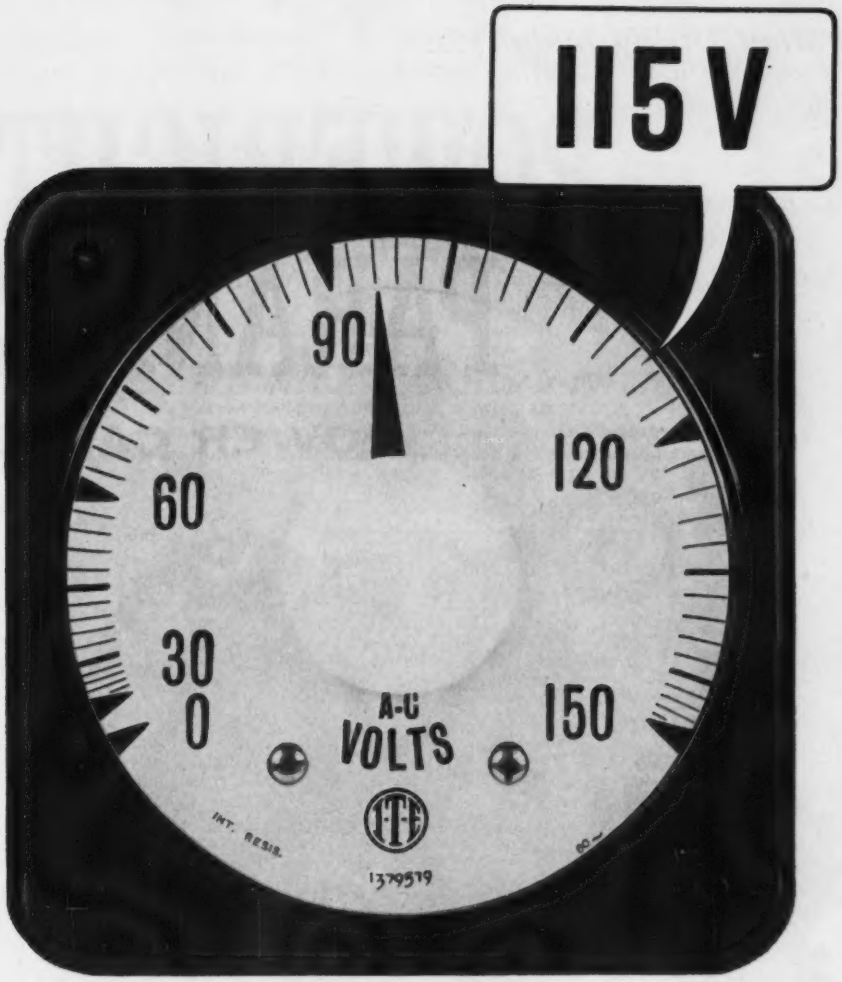
Whether your electric coil and rebuilding needs are standard or special, you'll be sure of performance when you call in National Electric Coil. We tailor-make the coils to fit your needs; offer all types of insulation. For information call National's Columbus plant... HUdson 8-1151 ... or call the nearest National field engineer.

NATIONAL COILS

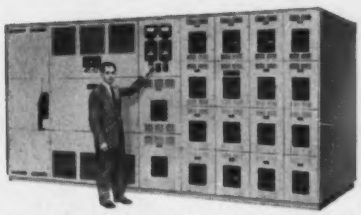
National Electric Coil

COLUMBUS 16, OHIO • IN CANADA: ST. JOHNS, QUEBEC

DIVISION OF McGRAW EDISON



"But I was positive we didn't need another substation!"



MORAL: For good voltage regulation and better operating efficiency, put a secondary unit substation in each load area. And for complete information on today's most value-packed line of substations, write for Bulletin 3104-1A, I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton Street, Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

Another Utility Installs...

POWERIGHT PARANITE®

POWER CABLE

A modern electronic computor system at South Bend, Indiana, is serviced by Paranite Super-Pararite® Paraprene® network cable installed by the Indiana & Michigan Electric Company. Three Paranite network cables were laid parallel in underground ducts from the primary circuit to the new I B M building.

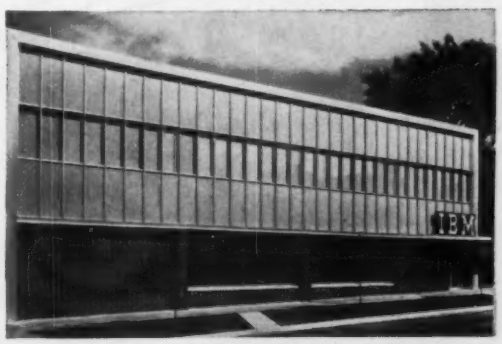
From 600 V. network through 28,000 V. power cables, Paranite has proven its dependability in coast-to-coast power installations. Paranite's engineering department invites your inquiry on specific problems relating to your application.

PARANITE WIRE & CABLE DIVISION

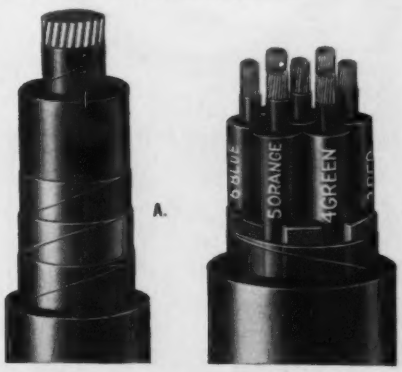
ESSEX WIRE CORPORATION, Marion, Indiana

MANUFACTURING PLANTS: Marion, Ind.; Jonesboro, Ind.; Tiffin, Ohio; Anaheim, Calif.

Sales Offices and Redistribution Warehouses in all Principal Cities



This recently completed IBM Branch office at South Bend, Indiana, handles the load of Data Processing Machines servicing nine counties in Northern Indiana and Southern Michigan.



A. Paranite HIGH VOLTAGE CABLES are manufactured in a complete range of sizes—1000 V. through 28,000 V. single conductor, 3000 and 5000 three conductor. Adaptable for aerial, direct burial or underground duct installation, wet or dry location.

B. Paranite CONTROL CABLES are produced in a complete range of insulation and jacket types. Rubber, PVC or Polyethylene insulations are available to meet a variety of service temperature conditions.

PROTECT BOTH VITAL AREAS

ANOTHER ASPLUNDH *"FIRST"*—

The Aerial Device That Gives You Complete Insulation From Ground

Once again Asplundh is the *first* to bring you a Safer Aerial Device. No longer need you fear a "HOT TRUCK." Should any part of the moving structure come in contact with an energized conductor the **SPIRALLOY** Upper Boom and **SPIRALLOY** Pylon Insert in the mast prevents the truck from being energized. Don't let an innocent looking vehicle be the cause of a possible tragedy.

"*Your public and your employees are completely protected from this type of hazard at all times.*" This added safeguard to those on the ground is made possible by a special section of **SPIRALLOY** (a non-conductive material) in the pylon mast.

Be sure. Be safe. Insist on the **SPIRALLOY** double ring of safety. Write today for additional information.

ASPLUNDH **Chipper Company**

501 York Rd., Jenkintown, Pa.

PUSH BUTTON PEAKING PLANT FOR MAINE PUBLIC SERVICE COMPANY

Electro-Motive Power plant to supply power
for peak loads, system reserve and area protection.

For details, turn page . . . . . .

Maine Public Service Company Installs

ELECTRO-MOTIVE PEAKING AND RESERVE PLANT

Load study determines need for peaking power.

The decision by Maine Public Service Company to install Electro-Motive peaking equipment resulted from a systems study which pointed up the need for additional generating capacity to handle increased peak demands. An Electro-Motive 4200 KW plant was selected for these reasons:

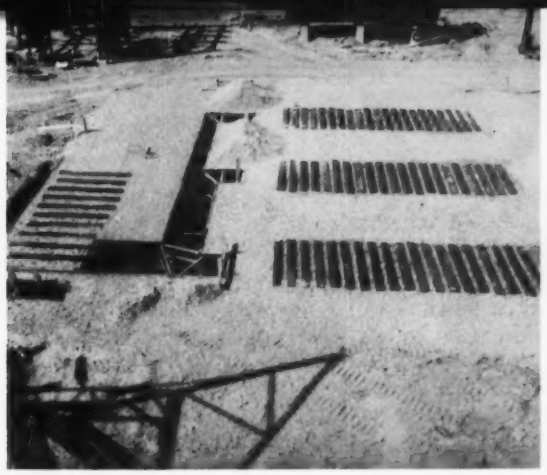
- **Low investment.** On the Maine Public Service System, the Electro-Motive plant has an annual fixed charge of less than $17 per KW per year, compared with $28 per KW per year for alternative equipment. Thus, the Electro-Motive plant provides an economical solution to short duration peak demands.

- **Unattended, remote operation.** The Maine Public Service plant is operated by push-button control from the company's central dispatching headquarters in Presque Isle, four miles from the substation where the plant is located. The plant comes on line and shuts down automatically on signal from the dispatcher.

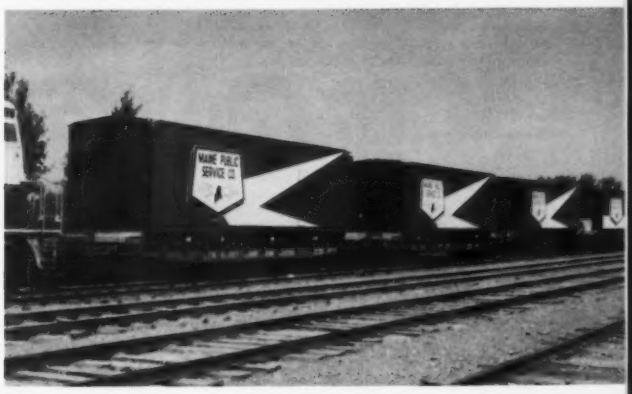
- **Quick start.** The plant comes on line and up to full load *in 60 seconds* on quick start, or 90 seconds on a normal start. Preparation time not required for peak. Immersion oil heaters keep engines ready for instant starting. Because of this, the plant qualifies as a reliable source of power for systems reserve and area protection.

Portable components simplify installation

Each of the components in the Electro-Motive plant is contained in a sound-deadened, weather-proofed housing. This unitized, self-contained design permitted installation costs of under $17 per KW for Maine Public Service Company. (Cost included shipping, site preparation, fuel tank, material and labor for electrical connections.) How the plant was installed is demonstrated in this sequence of photos:



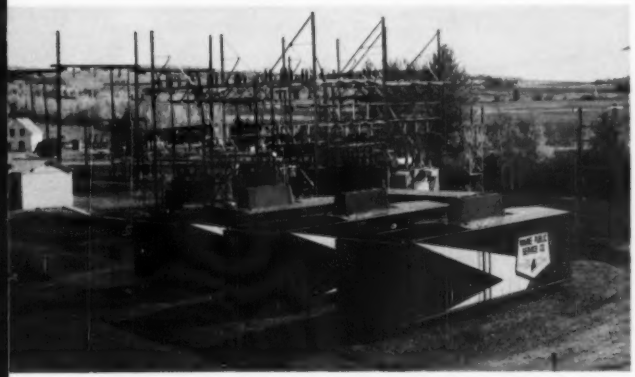
1 Preparation of site at the station began before plant arrived. Wood ties are set in crushed rock fill as foundation for skid-mounted components. Cable trough provides means for connecting cables and service lines. Note absence of concrete or other costly foundation work.



2 Plant was shipped by rail to Presque Isle from Electro-Motive Division in LaGrange, Illinois. Components are designed to ship on any standard flat car and meet standard railway clearance requirements.

3 Truck trailers were used to transport the components to the installation site at Flo's Inn station, four miles from Presque Isle. Components were styled in attractive green and white colors—caused favorable attention as they passed through the city.

4 At the site, cranes unloaded components onto the foundation ties. Engine-generator sets, balanced and vibration-free, eliminate anchoring or tie-down. Located right at the step-down substation serving the load, the plant's full capacity can be used where needed. This eliminates line loss which would occur if it were placed at the central station.



5 Completed installation three weeks later. The following week, after test and adjustment, the plant was qualified for commercial service for an average two hours a day. If desired, it may be moved to a new site as quickly as it was installed. A fourth generating unit may be added to boost capacity at low incremental cost.

For an analysis of the savings that can be derived from Electro-Motive peaking equipment on your system, contact your Electro-Motive representative.

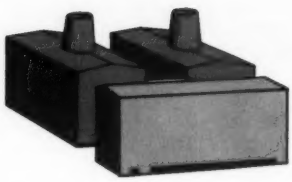
ELECTRO-MOTIVE DIVISION
GENERAL MOTORS La Grange, Illinois

Sales-engineering offices: Chicago, New York, St. Louis, San Francisco

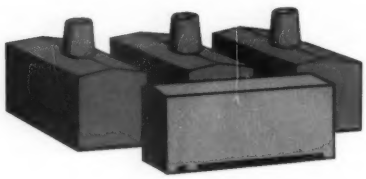
In Canada: General Motors Diesel Limited, London, Ontario

ELECTRO-MOTIVE PEAKING EQUIPMENT LINE

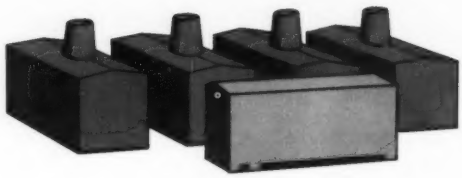
MU-20 2000 KW Diesel
MU-14DF 1000 KW Dual-fuel



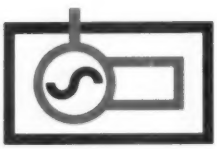
MU-40 4000 KW Diesel
MU-28DF 2000 KW Dual-fuel



MU-60 6000 KW Diesel
MU-42DF 3000 KW Dual-fuel



MU-80 8000 KW Diesel
MU-56DF 4000 KW Dual-fuel



The Electro-Motive peaking equipment line contains both Diesel and dual-fuel plants. Diesel plants range in size from 2000 KW to 8000 KW. Dual-fuel plants start at 1000 KW and run to 4000 KW.

With a complete range of sizes and two fuel types available, exact peaking requirements can be matched to provide the most economical and efficient operation at lowest investment. When load growth occurs, additional generating units may be added at low incremental cost to bring the plant up to desired size.

ROEBLING GAS-FILLED CABLE! looks out for your best interests!

Impregnated paper/insulation, with shielding.
Two steel spirals conduct inert gas to all parts of cable to prevent ionization and provide self-supervisory properties.
THE SHEATH ON THIS CABLE . . . is one more reason why it's a best buy! The Tellurium-Lead Alloy Sheath offers the best possible resistance to fatigue and age-hardening problems . . . has 90% less creep, 4½ times greater bending life!
Solid copper tubing is open at splices, assuring constant gas pressure in spiral tubes.
Non-magnetic shielding tape over cable core.

Roebling Gas-Filled Cable (for voltages up to 46 kv) is *self-supervisory!* Super-dry nitrogen gas, inside this cable at approximately 12 p.s.i. pressure, is the key. When gas pressure drops below 10 p.s.i. or rises above 16 p.s.i.—an automatic signal message is relayed to the nearest attended station. You know when trouble's afoot the second it starts! Repairs can be made *before* serious damage occurs!

Along with this extra *protection*, this cable has properties that lessen the possibility of outages! The inert dry nitrogen gas provides consistent dielectric properties throughout the length of the cable. It prevents ionization, too, and the other problems often associated with solid-type oil-impregnated cable. What's more, it's as easy to splice as solid-type! And if your system includes grades, it may prove to be the most inexpensive cable you've ever used!

Our new Gas-Filled Cable book tells more about this superbly-made cable. It's free—write for it. Roebling's Electrical Wire Division, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division, The Colorado Fuel and Iron Corporation

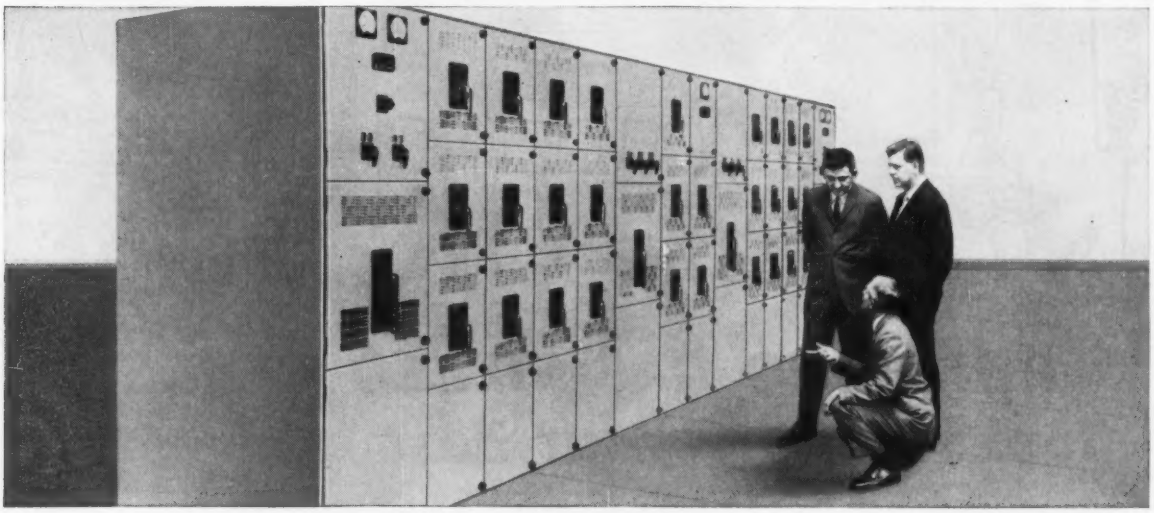
Maximum Value in Switchgear Flexibility... Safety...

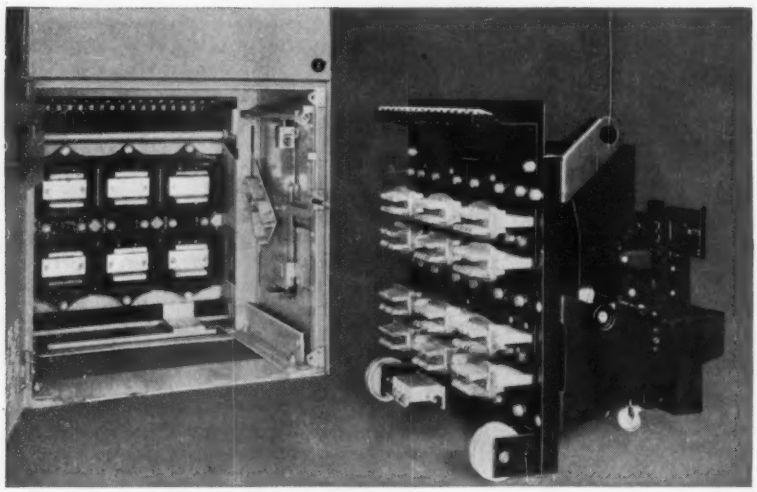
Westinghouse low-voltage, metal-enclosed switchgear is modern inside and out . . . loaded with features to assure you of a high return on your investment.

Absolute mechanical and electrical integrity is guaranteed with 100% use of Westinghouse components. Design performance is thoroughly proved in exhaustive tests at the Westinghouse High Power Laboratory.

Minimum cost is possible by specifying "Standardized" over-all design. Westinghouse "Standardized" switchgear meets all normal requirements within its rated interrupting capacity . . . eliminates additional engineering and manufacturing costs of expensive "specials."

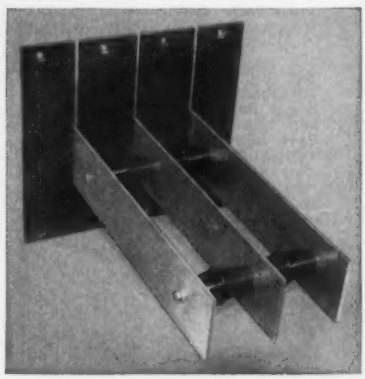
Nationwide switchgear manufacturing plants are ready to serve you . . . convenient for consultation and inspection during equipment construction. All units are thoroughly tested for conformity to NEMA standards. Where conditions permit,





Cluster-Type Disconnect Fingers permit quick inspection when breaker is withdrawn from cell. A spring-mounted floating retainer maintains full contact pressure and assures maximum current rating capacity despite minor variations in breaker alignment.

Glass Polyester Bus Supports and Short Circuit Bracing . . . provide ideal physical and electrical properties for low-voltage, metal-enclosed switchgear. The insulation is highly track resistant and flame retardant. Design of supports and bracing affords increased vertical creepage distances. Result: maximum safety with minimum maintenance.



Long-Term Operating Economy

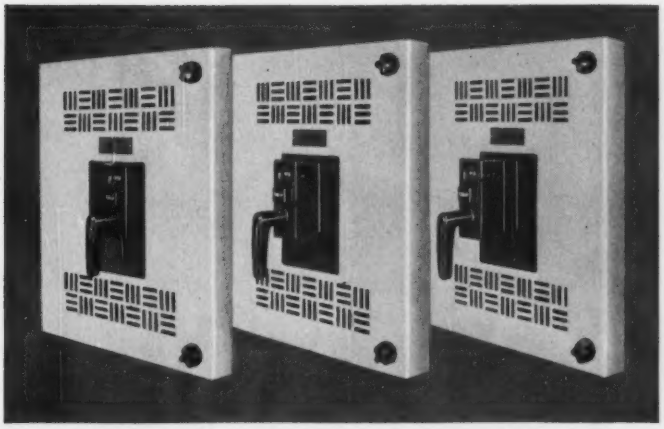
switchgear is shipped as one completely assembled apparatus.

And, mighty important . . . *Westinghouse assumes complete, undivided responsibility for the switchgear* from planning to the satisfactory overall operation of the installed equipment. For detailed information on low-voltage, metal-enclosed switchgear, call your Westinghouse sales engineer, or write: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

J-60704-B

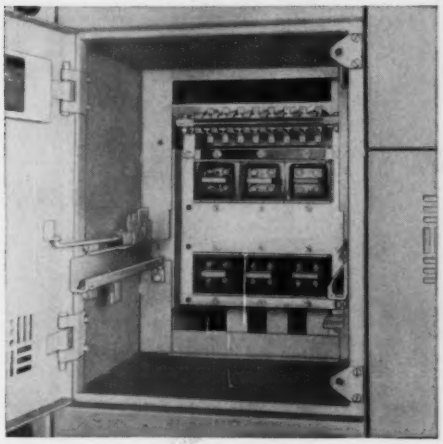
YOU CAN BE SURE...IF IT'S Westinghouse

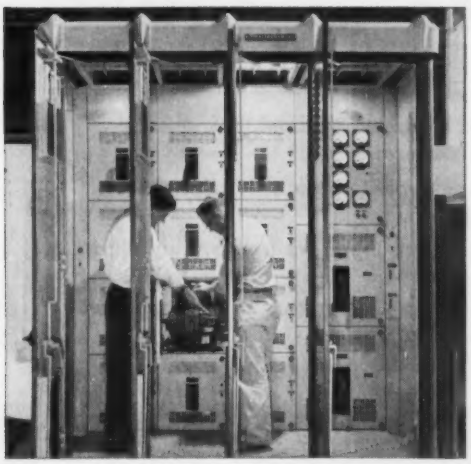
WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV ALTERNATE FRIDAYS



Three-Position Drawout Design permits the De-ion® type DB breakers to be in "connected"—"test"—or "disconnected" position with the breaker door closed. The breaker can be tested in complete safety and storage space for the breaker is also provided when in fully disconnected position.

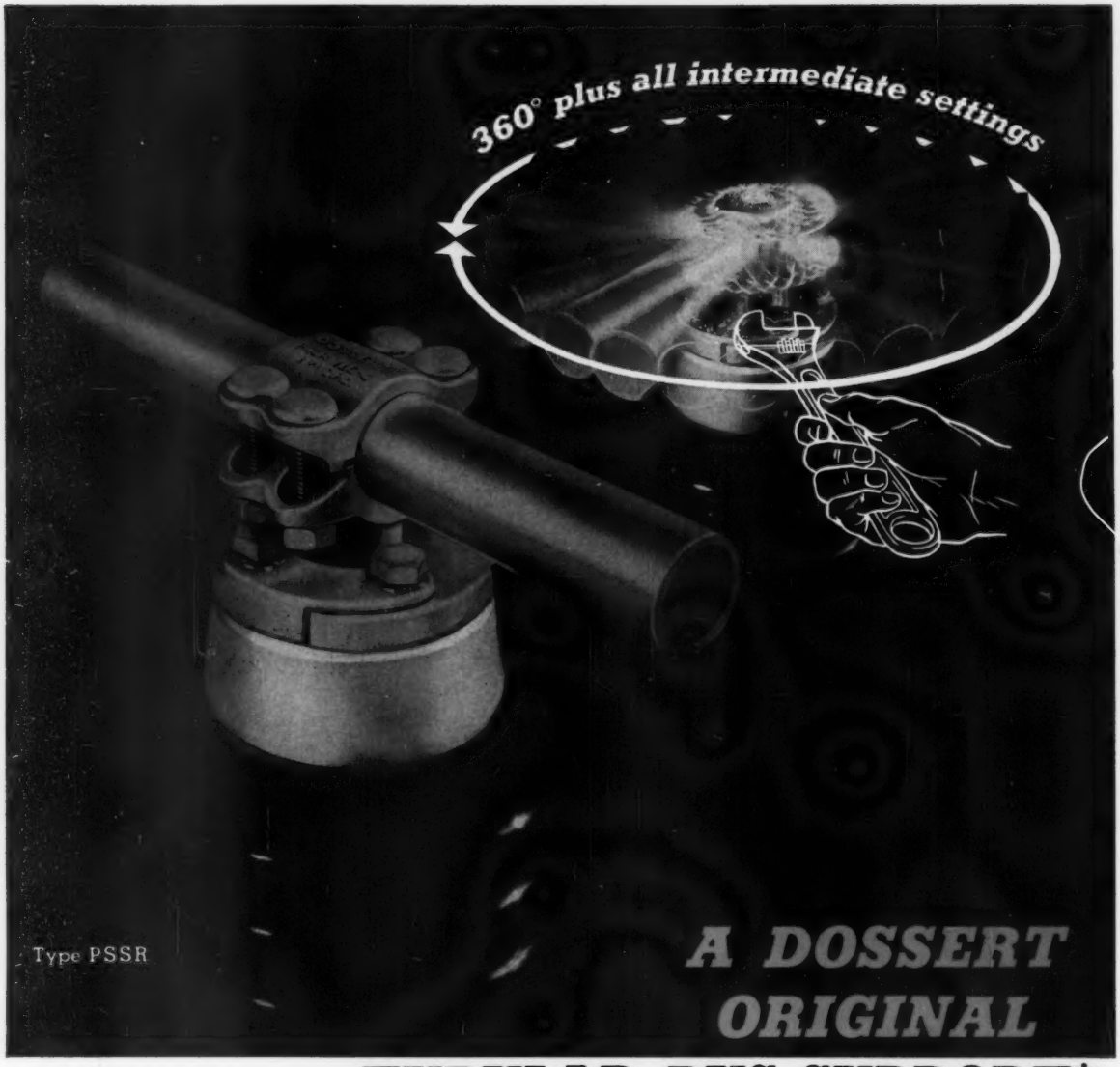
Individual Breaker Compartments include interlocks and positioning devices to assure safe removal or replacement of breakers. Dead-front design provides maximum protection and safety for operators and equipment.





"Walk-In" Aisle provides protected work space in outdoor units. Addition of this space to the weatherproof, functional design permits easy inspection and maintenance without exposure of equipment or personnel under all weather conditions.

Three Breaker Closing Mechanisms are available to match your requirements—dependent manual, independent manual, or electric—for DB-15, DB-25 and DB-50 breakers. NEMA standards specify electric mechanism for closing DB-75 and DB-100 breakers. The independent manual mechanism, shown below, assures uniform breaker operation—regardless of operator's motion—prevents delayed closing and excessive contact burning.



fully adjustable, TUBULAR BUS SUPPORT*

This bus support, made of high-strength bronze throughout, has the following outstanding features:

- Fully adjustable to any angle whatsoever within a complete circle (360°).
- No need to lift bus out of support to change angular position.
- To change position within seconds, merely loosen 4 insulator mounting bolts, rotate assembly to desired angle and re-tighten bolts.
- No inaccessible internal bolt employed for angular setting.
- The only bus support whose angular adjustment does not jeopardize its overall strength.
- By reversing cap bus can be tight-mounted or slip-mounted.

Write for illustrated brochure!

***U. S. PAT. 2,661,762**

50 YEARS OF TECHNICAL LEADERSHIP

DOSSERT MFG. CORP.

249 Huron Street, Brooklyn, New York

Representatives in principal cities.

Distributed outside the U.S.A. and Canada by

INTERNATIONAL GENERAL ELECTRIC COMPANY

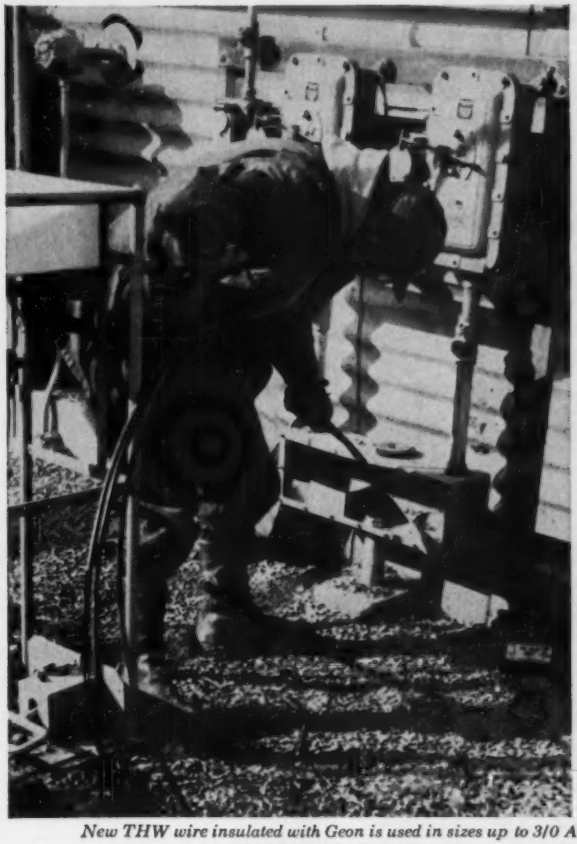
Construction Materials and Lighting Sales

150 East 42nd Street

New York 17, N. Y., U.S.A.

Another new development using

B.F.Goodrich Chemical *raw materials*



New THW wire insulated with Geon is used in sizes up to 3/0 AWG at this new Sohio plant. Wire is made by the Paranite Wire and Cable Division of the Essex Wire Corporation, Marion, Indiana. B.F.Goodrich Chemical Company supplies the Geon vinyl.

"We welcome the higher factor of safety"

. . . of new THW wire insulated with GEON vinyl

These pictures show new wiring going into the Sohio Chemical plant at Lima, Ohio. Here's what the contractor, W. W. Clark Corporation of Cleveland has to say about it:

"In a chemical plant or refinery, electrical wiring often has to go near processing equipment that operates at high temperatures. We try to keep it at least a foot away, but sometimes have to go as close as 6". We welcome the higher factor of safety this new THW wire gives us."

Now you can add new heat resistance to the proved properties of insulation of Geon vinyl. Geon is tough, weatherproof and keeps its exceptional properties with age. It also resists oils, greases and chemicals.

For information about Geon wire and cable covering, or other ways that Geon improves products or opens new markets, write Dept. GX-6, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Geon VINYLS

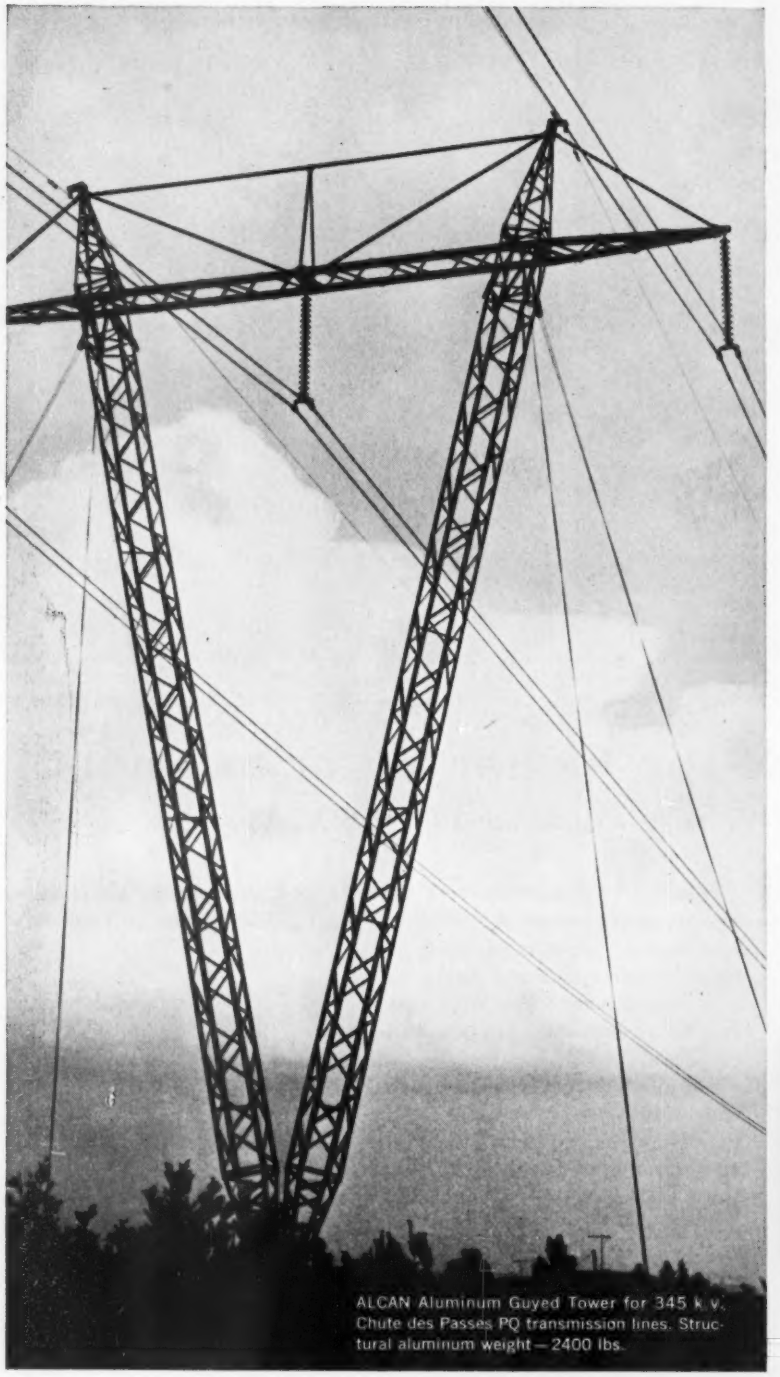
B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich

GEON vinyls • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers

From Aluminium Limited research–

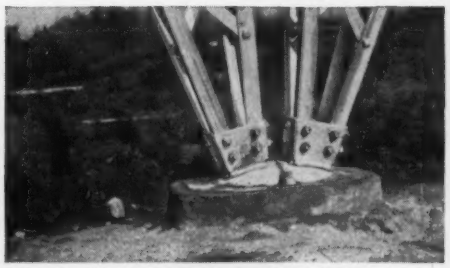
The ALCAN



ALCAN Aluminum Guyed Tower for 345 k. v. Chute des Passes PQ transmission lines. Structural aluminum weight—2400 lbs.

- Designed for installation on level ground . . . mountain or in swamp
- Weight savings of up to 80% due to the combination of efficient aluminum design and the guyed-tower principle
- Lightweight components are readily transported by panel truck, motorboat, helicopter . . . easily carried by hand
- Tower can be raised by one crew in minutes!
- Offers all the maintenance economies of aluminum

Michael Flynn Manufacturing Co., Philadelphia, Pa., are the authorized manufacturers for the ALCAN Guyed Tower.



When used in the "V" arrangement only one footing and four inexpensive guy anchorages are required—eliminating the need for precision in footing work. Side-hill problems of leg extensions are nonexistent.

Aluminum Guyed Tower

—a revolutionary new high-voltage transmission structure that "makes molehills out of mountains"

The ALCAN Aluminum Guyed Tower brings substantial economies to the construction of high-voltage transmission lines.

The new unit—designed for "V" or parallel leg erection—has been created by ALCAN engineers to take full advantage of aluminum. The resulting combination of lightweight metal and the guyed-tower principle has many advantages over rigid conventional types.

Versatile Application

Particularly well suited for single-circuit lines, the ALCAN Guyed Tower is adaptable to all types of terrain without the additional costs normally expected with adverse footings and side-hill conditions.

Economical Installation

A primary advantage of the new tower is a weight reduction of up to 80% less than the rigid steel principle. This results in lower installed costs through lower transportation expenses . . . lighter erection equipment . . . simpler footing alignments . . . reduced erection time.

Easily Handled

All ALCAN Guyed Tower components can be delivered to the erection site with no need for special carriers or heavy lifting gear. Lightweight 20-foot leg sections weighing less than 200 pounds and major cross-arm pieces are readily handled by workmen without need for auxiliary equipment. This permits inexpensive yard assembly of a major portion of the tower before distribution to the tower sites.

Simple Assembly

Depending on the height required, only six to ten standard leg sections and a cross-arm go to make up each tower . . . sections can be quickly joined during ground assembly of units.

Single or Twin Base Erection

The ALCAN Aluminum Guyed Tower can be erected on a single base in the form of a "V" or on twin bases as a portal type, whichever style best suits conditions of terrain and right of way.

Fully Tested Design

Ultimate load tests on components as well as on complete towers have been carried out to establish the behavior of this arrangement and to confirm design principles. Special footings and guy anchorages located in marshland, loose sand, packed earth and rocky terrain have also been tested to full design loadings.

This development and test program resulted in the installation of four guyed towers in the ALCAN 345 k.v. Chute des Passes transmission system. Ranging from 76 feet to 96 feet from base to cross-arm, two are located on rock and two were installed in a swamp.

Uses Special High-Strength Alloy

The new ALCAN Guyed Tower is made of another Aluminium Limited development—ALCAN B51S aluminum alloy, which keeps costs low through a combination of high structural strength and good formability. Like all aluminum structures—maintenance costs are minimum.

Aluminium Limited

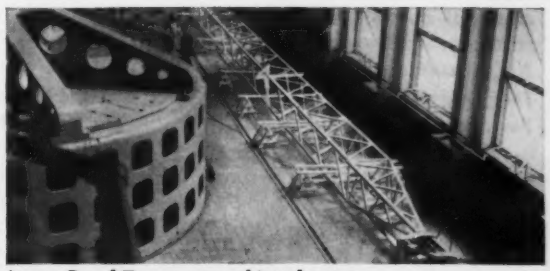
ALCAN

INQUIRIES FOR ADDITIONAL INFORMATION SHOULD BE ADDRESSED TO

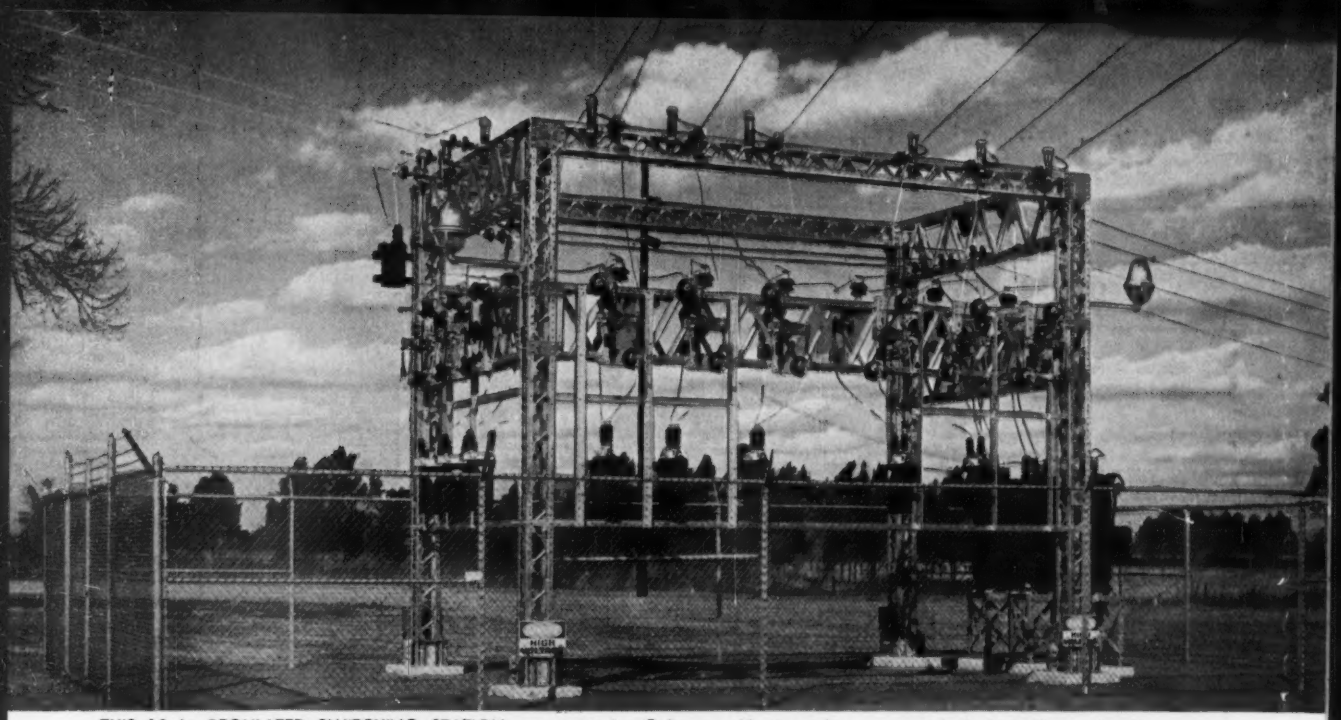
Aluminium Limited Sales, Inc.—630 Fifth Avenue, New York 20, N. Y.

CLEVELAND • CHICAGO • LOS ANGELES • DETROIT • ATLANTA • ST. LOUIS

ALCAN Aluminum Guyed Towers over 100 feet in height have been raised in less than seven minutes from preassembled position on ground using standard pole-line truck and rigging. In rough terrain tower can be erected in large lightweight sections.



ALCAN Guyed Towers were subjected to tests by Aluminium Limited at Isle Maligne, Quebec, Powerhouse, with single legs up to 96 ft. in length, under loads of 93,000 lbs.



THIS 12 kv REGULATED SWITCHING STATION was erected by a line crew in only 48 minutes. Although this crew had no previous erection experience, the men were still able to install this L-M-Alrectic aluminum substation in an amazingly short time. Columns and horizontal trusses were bolted together and equipment was mounted before the sub-assemblies were erected. Sub-assemblies were then hoisted by means of the regular line-truck hydraulic hoist.

L-M-Alrectic® Aluminum Substations Are Competitive With Steel Structures

Special light-weight design, which facilitates faster installations, makes L-M's aluminum substations competitive with steel substations on an erected basis.

by **W. V. SWAN**
Product Manager
Power Switching • Substations
Line Material Industries

L-M-Alrectic aluminum substations are constructed with standard factory-assembled trusses. Each truss consists of specially designed extruded chord-angles and lacing members that are factory-welded, using fixtures. Because of special design and construction, Alrectic trusses weigh only 30% of comparable steel trusses, but bear equal stresses.

Fast, Economical Installation

Column and horizontal trusses are all pre-assembled when delivered to the job site. They need only to be laid out and bolted together. Alrectic substations are fabricated of aluminum and require no special treatment—no painting, no maintenance. As a result, distortion from galvanizing is eliminated and assembly problems are minimized.

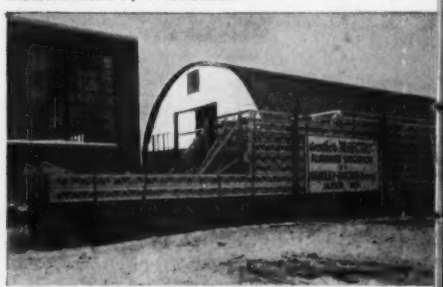
Because of lighter weight, the trusses are easy to handle. Much of the structure can be ground-assembled without a crane. Ground-assembled structures can then be lifted into place with light-duty lifting equipment. Erection of Alrectic substations is easier, faster and, above all, more economical.

Alrectic Competitive with Steel Substations

Special light-weight construction, most economical design, and fast economical installation make it possible for L-M to supply the Alrectic aluminum substation at costs equal to and, in many cases, lower than, steel structures.

Get Complete Information

Be sure you contact your L-M Field Engineer and get all the facts on the Alrectic aluminum substation. The next time you plan a substation, ask your L-M Field Engineer to submit a bid on an aluminum structure. Or write me at Line Material Industries, Milwaukee 1, Wisconsin.



ALL ALRECTIC columns and trusses are fabricated at the factory and are shipped pre-assembled. Light-weight design permits shipping the entire substation on one truck or rail car.

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LINE MATERIAL Industries
McGRAW-EDISON COMPANY
439 Substations and Power Switching Equipment

McGRAW EDISON

DISTRIBUTION TRANSFORMERS • RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT

Editorial Comment

MAY 23, 1960

Electric House Heating—Forecasts Aren't Enough

Ask yourself this question: "Is one of every four new homes in my service area being electrically heated?" If the answer is "no," then you're already running behind in your promotional activities for the decade of the Sixties.

The most conservative forecast of electric house heating is for four million installations by 1970. For each utility that figures out to nearly one in every four of the 15 million new housing units that are to be built during the decade. If we are to realize the more optimistic forecast of six million installations by 1970, a forecast made in good faith by the National Electrical Manufacturers Association, then we must figure that on the average two out of every five new homes must be heated electrically.

The forecast of four million installations is made by Electrical World and is factored into our predictions of industry kwhr sales for 1970. Without specifically referring to it, Edison Electric Institute is also counting heavily on electric housing heating to attain its prediction of 7,555 kwhr average use per customer in 1970.

All of those who make forecasts for the electric industry—EEI, NEMA, Electrical World—realize that they can do no more than set reasonable goals. There is a lot of hard work to be done between setting those goals and attaining them.

That work must be done by the top management and the commercial departments in each individual utility. Each electric heating installation attests to the confidence which the utility and its allies has fostered in this versatile new means of building comfort into homes. It attests, too, to the careful planning and the hard work of commercial department men.

Occasionally we get the idea, and hear it expressed by others, that forecasts serve a bad purpose. They lull some people into complacency. The false notion creeps in that these goals can be attained merely by moving ahead in routine fashion, showing patience, and waiting out the decade to see the four million installations appear as if by magic.

It won't work that way. The forecasters are counting on more persistent sales efforts, more imaginative sales programs, and more effective promotional campaigns. Unless these materialize, the forecasters will be left high and dry. But much more serious than that, the industry will lose some of the esteem it has gained as a result of healthy and constant growth.

Encourage Employees to Bear Political Responsibility

The election-year excitement already being generated by the primaries serves to remind us that we have an individual role to play in politics. For some, it means running for office at the local or state level. For most of us, it means taking an active part in campaigns. For all of us, it means putting an X on the ballot.

A number of utilities find it to their long-range best interest to encourage employees to bear their full responsibility in political activity. We believe other utilities should consider this policy for possible adoption.

No FPC Influence Proved Yet

FPC Commissioners Kuykendall, Kline, and Connole deny influence charges as subcommittee hearings get underway. List of witnesses will be selected from FPC case log

Startling disclosures were missing as Rep Oren Harris' investigation of the Federal Power Commission moved into a second week, but there was a full record that private meetings between utility officials and Commissioners had become routine.

For the investigators of the House Legislative Oversight Subcommittee, the meetings raised these questions:

Are these private meetings necessary?

If so, what can Congress do to prevent them from exerting an improper influence on the agency?

FPC Chairman Jerome K. Kuykendall, Vice Chairman Arthur Kline, and Commissioners William R. Connole and Frederick Stueck freely testified to their frequent meetings with spokesmen of all segments of the natural gas and electric industries.

In addition, they said that they have accepted transportation provided by industry to inspect natural gas and hydroelectric facilities.

All these meetings are proper, and seldom, if ever, get into the merits of pending cases, they insisted.

Further, they held the private meetings to be necessary to the prompt transaction of routine, noncontested Commission business, and essential to keeping abreast of broad industry problems and plans.

After spending six days on Chairman Kuykendall, Kline, Connole and Stueck, it became obvious that House investigators had put a fine tooth comb to all the records they could find in the Commissioners' files. Chief Investigator Robert W. Lishman came up with long lists of conversations and meetings taken from the Commissioners' appointment books and came close to trying to establish "guilt by association"—that is, he noted time after time that a private meeting with an industry man was followed within a day or two by a Commission decision affecting the representative's company.

Actually, the committee at midweek had not yet established any real evidence that such meetings had indeed affected the outcome of a single decision. But the fabric of circumstantial evidence being laid down made it clear that the critics were trying to paint a picture—if not of wrong-doing—of Commissioners so close to the industry they regulate as to raise a substantial question of their impartiality.

The adversaries on the subcommittee began to separate clearly on this line: defenders of the Commissioners' actions are Congressmen from producer districts, or have a pro-producer background; critics of the Commissioners are from consumer areas.

Don't Isolate the Commission

Several Congressmen, including Chairman Harris, agreed that the Commissioners shouldn't be sealed off like judges from industry contacts.

But they wanted to know if any of the pending "ethics code" legislation, outlawing improper relationships and unusual hospitality, might not curb abuses, or discourage the appearance of improper relationships.

The Commissioners agreed that this legislation might be useful, and also backed the use of federal funds to pay for necessary field trips by Commissioners to industry facilities.

The exhaustive Legislative Oversight Subcommittee inquiry centered on the natural gas industry, with no questions raised thus far of improper acts by electric industry spokesmen.

The circumstances of the off-record meetings that prompted the investigation were detailed by the three Commissioners involved, Kuykendall, Kline and Connole. They all reiterated that they weren't influenced.

These meetings were held last October with Lawyer-lobbyist T. G. Corcoran, Washington representative of Tennessee Gas Transmission Co and its subsidiary, Midwestern Gas Transmission Corp, while the Commission was discussing the subsidiary's application to serve the Upper Midwest.

The sole issue dividing the Com-

HARRIS AND BENNETT, l and r, after receiving testimony from FPC members

KUYKENDALL

CONNOLE

KLINE

missioners was what rate-of-return the company should get.

Corcoran Defends His Contacts

Corcoran in his first statement since the controversy began a couple of months ago testified that he had every legal right to contact the Commissioners while they were considering the case because the company's "only adversary," the FPC professional staff, has similar off-the-record contacts.

He said his visits were "in full conformity with all applicable laws, rules and regulations," and commented that they weren't "secret." Corcoran said he always goes to the Commission's public offices "in daylight with a brass band behind me."

He said he took a "procedural approach" with the Commissioners, arguing that unless the FPC permit left the door open for favorable financing the company would reject it, or ask for new hearings.

The Congressmen will also question Gardiner Symonds, chairman of Tennessee Gas Transmission, about his statement that such meetings as Corcoran's are both legal and accepted industry practice.

Rep John Bennett, Michigan Republican, charged Symonds with "deliberately and intentionally" sending Corcoran to influence the Commission off-the-record.

He said Kuykendall used "very bad judgement" in allowing Corcoran to discuss the case with him, but said he didn't think Kuykendall should resign.

Kuykendall agreed that Corcoran's discussion with him about the rate-of-return issue was "improper," but he angrily told Bennett: "If you are insinuating that any member of the Commission wanted to give the company a higher rate-of-return than it deserved, then you are 100% wrong and so is anyone else in this whole wide world."

Bennett insisted that the Corcoran meetings were "unfortunate, foolhardy and indiscreet."

Kline and Stueck were questioned sharply by Lishman concerning their appointment books, showing a steady stream of industry callers.

Neither Kuykendall nor Connole keep engagement books, but Connole testified to meetings with many persons seen by Kline. "This is an honest business," Connole insisted, "I have never found a crook . . ."

Lishman attempted to establish a link between meetings with industry spokesmen and Commission actions by comparing dates of the visits with the Commission's files.

The Commissioners denied that specific cases were ever discussed, and said that most large companies constantly have cases pending.

Kline and Stueck both testified that they didn't recollect the topics discussed at many of the meetings.

Often, Kline said, conversation was about procedural questions. In other instances, he said, the calls were social, involving golf dates, and, in one case, Boy Scout activities of his son and the son of an industry representative.

These relationships, Kline insisted, "have absolutely no effect" on FPC decisions.

However, Harris wanted to know why Kline had such clear recollections of his meeting with Corcoran, but couldn't give details of the other meetings.

Kline explained that the Commissioners had discussed Corcoran's visits. He also conceded to Harris that no report of the Corcoran visits would have been made to the subcommittee had it not been for a disclosure in an oil paper.

Connole Grilled by Derounian

Rep Steven B. Derounian, New York Republican, selected address cards from Connole's files, and established that Connole meets many pipe line and producer representatives.

Then he remarked, "For a consumer's man, you've palled around with an awful lot of gas producers and owners."

Connole disavowed the label "consumer's man" and said he isn't beholden to any group. He said he conceives a healthy industry to be as much in the public interest as control over prices.

Harris challenged Derounian's tactic of picking cards selectively from Connole's files. The Arkansas Democrat then chose cards indicating Connole's contacts with state public utility commissioners, financial experts and utility company officials.

Interior Unveils Its Plan For Upper Colorado Lines

Interior Dept's transmission-line and marketing-area plans for Upper Colorado storage project were unveiled last week by Secretary Fred Seaton. While his recommendations do not say whether the lines will be built by federal, public, or private means, they will probably be used as a basis for making the decision.

Seaton's recommendations also go to Capitol Hill, where the Senate Appropriations Committee may use them to decide whether or not to include funds for federal lines.

The recommendation on private, federal, or public lines will be made "shortly" by Interior Dept, and this also will be sent to Capitol Hill for consideration.

The Department's recommendations call for a series of 230-kv, 138-kv and 115-kv lines, interconnecting the three hydro power dams —Glen Canyon, Flaming Gorge, Curecanti—with potential preference customers and existing utility substations in the area (see map).

Lines would be as follows:

- Three 230-kv lines between Glen Canyon and Four Corners.
- Two 230-kv lines between Glen Canyon and Phoenix, Ariz., substation, between Four Corners and Curecanti Dam, and between Curecanti and Pueblo, Colo;
- One 230-kv line between Curecanti and Rangely, Colo., and between Four Corners and Albuquerque, N. M.;
- Three 115-kv lines between Heber and Vernal, Utah;
- Two 115-kv lines between Vernal and Rangely;
- Single 115-kv lines between Vernal, via Flaming Gorge Dam, to Pilot Butte, Wyo., between Rangely and Craig, Colo., between Curecanti and Montrose, Colo., and between Curecanti and Gunnison, Colo.;
- A single 138-kv line between Glen Canyon and Fredonia, Utah.

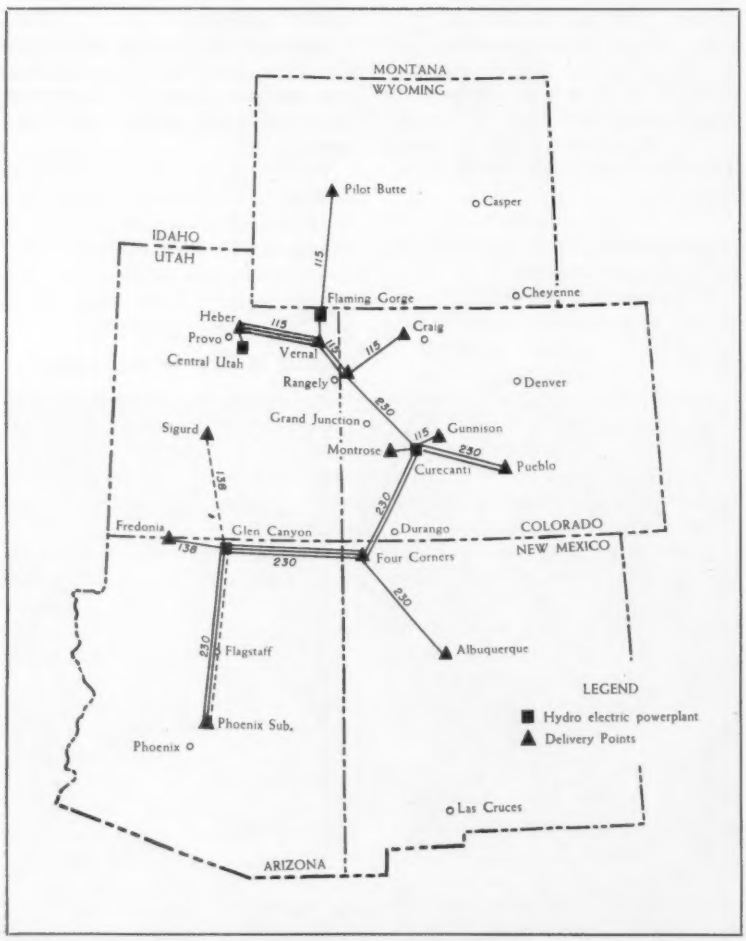
Possible additions—not definite—would be a third 230-kv line between Glen Canyon and Phoenix (dotted), and a 138-kv between Glen Canyon and Sigurd, Utah.

Construction of lines south of Glen Canyon would require assurance that power sold there could be withdrawn to meet future loads in the Northern (or upper) division. The Northern division would consist of Colorado, New Mexico, Utah and Wyoming; the Southern division would consist of Arizona, Clark, Lincoln, and Nye Counties, Nev., and California East of the 115th degree of longitude.

Preference customers will get first chance at firm power, with Northern division customers' 1965 net needs taking preference over Southern. Extra firm power will be sold on short-term contract. Interior will revise preference sales periodically, not greater than two-year intervals.

The report doesn't indicate the total mileage of lines involved.

SECY SEATON—Unveils a new plan



INTERIOR'S PROPOSED TRANSMISSION SYSTEM for Upper Colorado Storage Project is shown above. It differs from proposed private and preference plans

PUD's Given 90 Days on Nez Perce

FPC Examiner Emeroy Woodall postponed hearings on the conflicting Nez Perce-High Mountain Sheep hydro power applications for 90 days last week, striking one month from the postponement request of the Washington Public Power Supply System.

New dates are:

Aug. 15—filing of all direct testimony by Nez Perce and High Mountain Sheep applicants;

Sept. 19—filing of testimony by intervenors;

Oct. 17—hearings commence, devoted principally to cross-examination of opposing applicants testimony and plans.

Woodall ruled that the Nez Perce applicants' request for a delay to mid-November pushed the case into the Christmas Holidays, too late to be practical. He also recommended another pre-hearing conference in early October to line up witnesses, plus a special conference among fish technicians in Portland, Ore.

Nez Perce applicants had asked Woodall for a four-month delay in the hearings—from July 18 to Nov. 14—plus a comparable delay for filing initial testimony. High Mountain Sheep applicants, Pacific Northwest Power Co, said they were ready to procede in the case, and criticized the postponement request and last-minute filing of the Nez Perce application as delaying actions.

Extension Allows Fish Studies

The extension of time should give the Washington public power group a chance to complete their application involving fish facilities.

A special pre-hearing conference was held May 16-17 at the FPC between all parties to decide the timetable and ground rules for the hearing. In addition to setting a new date for the delayed hearings, a special engineering session took place to determine what criteria would be used to compare Nez Perce and High Mountain Sheep data. Particularly to be settled upon were comparable elevation and river-flow data.

The conference was held on the date originally set by the FPC for filing of all direct testimony by both parties—a new procedure set up to take care of conflicting applications. Under this procedure both parties are to file all testimony concerning their proposed projects in writing at the same time. This would prevent any advantage to either party resulting from a time-lag in presenting orally the two projects. At a later date hearings would be held to cross-examination of each position, and for additional comments. Intervenors' testimony would be submitted in writing after written filings by the applicants, but before the start of hearings.

Hearings on PNP's proposed High Mountain Sheep project had originally been set to begin Mar. 21, but the 11th-hour filing of the Nez Perce application delayed the March hearings, and resulted in a consolidated case.

No Federal Law for Co-op Area Fights

Electric co-op leaders hope to solve the growing problem of territorial conflicts at a local or statewide level, according to Charles M. Stewart, manager of the Warren Rural Electric Cooperative Corp, Bowling Green, Ky. "It's a national problem," he said, "but we don't want to cure it with federal legislation." Stewart has just been elected president of the REA Electric Advisory Committee.

The committee, meeting in Washington May 12 and 13, discussed major co-op problems and plans for the future. The 15-member group was set up by REA Administrator David Hamil when he came into office several years ago.

Stewart told a press conference following the meeting that co-op leaders are concerned with the difficulties in holding their ground against expansion of municipal and power company systems in areas where co-ops are located next to mushrooming towns.

Stewart also stressed the "need for protection" of co-op finances when they are forced to sell out. He pointed out that most facilities, sold to municipals or companies were priced at cost, or near-condemnation rates. They ought to be sold on a "going system" price.

Stewart said that the advisory committee also discussed federal power supplies, as power supply is "always a problem to power distributors." He pointed out that co-ops are looking for power supply on an area basis. He urged power companies to update fuel clauses.

No discussion of joint municipal-co-op power supply was held, although Stewart and Hamil both agreed that interconnection and integration of systems is a coming thing. Hamil cited a new steam power plant being built near Muscatine, Iowa, to be used jointly by the Muscatine Municipal System and Eastern Iowa L&P Co-op.

AEC Gives Intermediate OK For Dresden Full Power

An Atomic Energy Commission hearing examiner last Monday issued an intermediate decision giving the Commonwealth Edison Dresden nuclear powerplant a conditional operating license at its full 180,000 kw capacity.

The examiner's order, in effect, allows the powerplant to move up step by step from its presently authorized half power operating level (90,000 kw) to full power. But, before AEC issues a final operating license, Commonwealth must submit reports regarding: (1) operating and safety conditions of the reactor at rated power tests up to and including full capacity, and (2) a training program for Commonwealth employees for assuming direction and operation of the atomic plant from personnel of Dresden's builder, General Electric Co. Then, within 90 days of submission of these reports, Commonwealth once again must come before AEC requesting a final operating license.

F. M. REINHOLD*

S. L. KOSLOW

D. E. NESBIT

Purchasing Organization, Surplus

EEI Purchasing & Stores Group also studies ways of evaluating stores performance; exchange information on stores training, open-end purchase orders, and trends in inventory procedure

Utility purchasing and stores men came back from their annual Edison Electric Institute Committee meeting in Philadelphia earlier this month with a hatful of ideas for improving performance and probably a few useable suggestions for saving dollars.

Sticking close to the theme of "progress through performance," meeting speakers dealt with policy as well as nuts and bolts problems.

Strong suggestion for centralizing authority for material management activities in each utility under a single head was put forward by F. M. Reinhold, vice president, Connecticut Light & Power Co. Drawing heavily on the results of a 37-utility survey of purchasing performance, Reinhold concluded:

"It would appear that the most effective organization would have responsibility for all areas of material management such as purchasing in its various phases, storeroom operations, traffic, reclamation and disposal of scrap and usable equipment . . . The placing of full responsibility for these functions with a single department head can make for an integrated department which should result in some important economies and be more effective in its contribution to the company it serves."

Reinhold also cautioned against piling too much work on buyers, arguing that purchasing men can perform their tasks most effectively if they have time to explore all possibilities of better prices, lower transportation cost, and other matters.

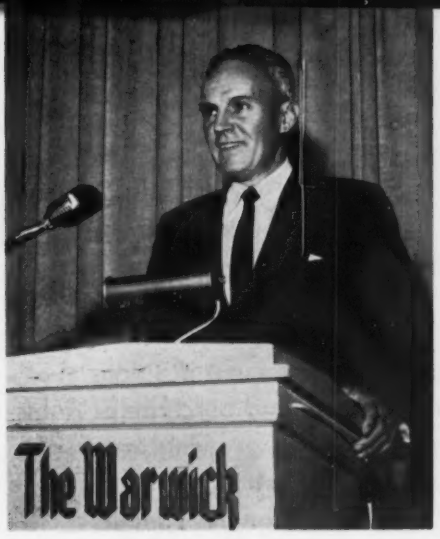
A survey reported by J. F. Estill Jr, vice president, Houston Lighting & Power Co, indicated that few utilities are getting fair value for usable materials which they must sell. Estill quoted another committee member as saying "Too much good material and equipment is being junked or simply left to deteriorate in inventory . . . It is a part of our national 'tragedy of waste.'"

Among the suggestions offered for improving disposal procedures was one for creating a central clearing house. Such an agency would maintain an up-to-date list of available surplus materials from all utilities so that such material could be considered for purchase by industry buyers. But Estill said that the survey results indicated that such a clearing house would provide only moderate improvement in disposing of unused surplus and little or no improvement in the disposal of obsolete equipment or used surplus.

(For further details on the papers by Reinhold and Estill, see the Management Newsletter beginning on page 119.)

A panel of speakers on stores employee training programs indicated that utilities have a wide range of practices in this field. G. A. Spencer, Detroit Edison Co, reported that his company has experienced instructors to teach equipment operation and application of company procedures. Supervisors may request help as they need it—either for training new employees, or improving performance of more seasoned employees. Stores employees at Detroit Edison also receive training as requested through many company programs

(*Also see Management Newsletter, p 119)



M. C. ROSS

J. F. ESTILL, JR*

Disposal Highlighted at Meeting

and special training programs designed for specific needs.

On-the-job training of stores employees is stressed at Duke Power Co, reported M. A. Edwards. Supervisors are in charge of the training, and strive to have men ready to fill a stores job when the occasion arises.

An intensive training and safety program is provided for Commonwealth Edison Co stores employees who operate materials handling equipment, said W. S. Marks. A practice area simulating difficult maneuvering problems is also used by employees learning to operate such equipment.

Formal and thorough indoctrination program is set up for all employees coming into the stores operations at Philadelphia Electric Co, reported C. V. Myers. Supervisors are given special courses in employee training.

An impassioned plea to find means of measuring stores performance was made by R. B. Gear, Commonwealth Edison Co, following an afternoon workshop session on the subject. "If we are going to be able to talk intelligently to management about our responsibilities, we must find common means of measuring and evaluating stores performance," Gear said. S. L. Koslow, Long Island Lighting Co, conducted the session.

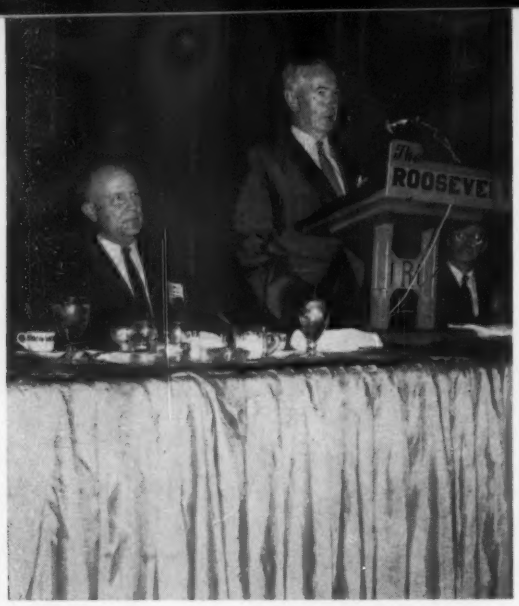
C. L. McCamey, Cleveland Electric Illuminating Co, who led one of 10 discussion groups studying store performance said his group felt that an acceptable method of evaluating performance could be worked out.

D. E. Nesbit, Duquesne Light Co, reporting on use of open-end purchase orders, said this procedure was widely used and was generally thought to be economical of both time and money. However, he cautioned that it required policing if the full savings are to be realized.

Reporting on trends in inventory procedures in utilities, Marvin C. Ross, Columbus & Southern Ohio Electric, said mechanization of inventorying was now widespread.

Discussion following Ross' report indicated that several companies are considering broadening their list of exempt material, material not specifically charged to line crews.

TRAINING PROGRAMS FOR STORES EMPLOYEES are discussed by M. A. Edwards, G. A. Spencer, W. S. Marks, and C. V. Myers at stores meeting



Manpower for tomorrow must be found today . . . *MacInnes*

SEE Engineers Look

- Action must be taken to attract suitable candidates for management positions
- Advance planning and purchase of rights-of-way are essential in growing areas
- Optimum distribution system may be planned using digital computer methods
- Automation aids economical data logging and generator operation

Engineers and operating men took a closer look at problems facing their managements before they plunged into their specific interests at Southeastern Electric Exchange's Engineering and Operation Section meeting in New Orleans. Their attention was directed to:

- The need to recruit tomorrow's manpower today.
- Inflationary pressures of continued government spending.
- A growing corporate awareness of action in public affairs.
- Advance planning in rights-of-way procurement.

Getting down to the business of utility engineering and operation, the meeting turned to:

- Distribution system planning through use of digital computers.
- Portable substations up to 25 Mva for economical use of transformer capacity.
- Microwave to protect a 230-kv transmission system and for communications.
- Automatic logging and computer control for economical generation.
- Growth in underground telephone facilities in residential areas.

Management manpower for tomorrow is management's most pressing problem today, said W. C. MacInnes, Tampa Electric Co's president. "We can no longer think in terms of how the job was done yesterday. We must . . . prepare ourselves and our successors for tomorrow's responsibilities."

MacInnes observed that Southeastern utilities need several hundred men each year for management responsibilities. He advocated:

1. Making the industry known to talented young men.
2. Improving recruitment methods.
3. Demonstrating that the industry provides economic rewards and a highly satisfactory career.
4. Scheduling on-the-job training for completion before the job needs to be filled.
5. Providing continuous evaluation and guidance to correct weaknesses.
6. Assigning responsibility while the man is young enough to carry it and enjoy completing his programs.

"The manpower shortage is certain to get worse in the next decade," warned W. M. Colquhoun, Ebasco Services. The shortage will grow because of increasing population, proportionately smaller work force, a vast volume of engineering work, and new and baffling problems. Utilities will have to increase their staffs to maintain their hard-won reputation for providing quality service.

Recruitment of young engineers, a major problem for some time, promises to become even more difficult. Thus, it seemed probable to Colquhoun that the next ten years will see a "tightening up" of the integrated engineering staffs of utilities and service organizations. The limited supply of competent engineers and supervisors will force improvements in the organization and efficiency of such groups.

Inflationary tendencies will continue to the extent that voters continue to demand more government spending, stated R. W. Elsasser, management consultant. Prices have shown close correlation with government costs over the past 20 years, except for World War II. Thus, most of the inflation since 1940 has been due primarily to the increase in government spending.

Most taxes are shifted ultimately to the consumer, said Elsasser, concealed in the price of goods. The consumer is not only unaware of this burden but also disinterested, as is shown by a mass public clamoring for more public spending. Although some analysts have concluded that inflationary pressures have subsided, it seems significant that easing of the money markets is already bringing new local and state spending proposals. Heavy spending in these areas may also be inflationary.

The field of practical politics, or public affairs, is emerging in American business as a multi-faceted movement, said J. J. Wuerthner Jr, consultant, General Electric Co. This movement centers around open activity and interest in the nominating, electing and checking of actions of those in government.

The movement is an attempt to upgrade and revitalize American political parties and strengthen our system of self-government. In the three years of development, said Wuerthner, there has emerged an

at Management Problems

awareness of management responsibility to discover and manage corporate political resources. This has led to the study, research and formulation of plans by many major corporations in the public affairs field. In turn, this has created a need for corporate "public affairs" personnel in several dozen companies.

The most publicized trend is the emergence of practical politics courses, with an estimated 100,000 "alumni" by the end of this year. Wuerthner pointed out that one area of the movement involves the corporation, its officers, spokesmen and public affairs people operating on a non-partisan basis in the legislative and public issues field. This means they first identify the issues of interest to the company. Then, the issues and arguments are evaluated and communicated to many groups, including employees, shareowners, government officials and neighbors.

Proposes Buying R/W in Fee

Management policy also is involved in the procurement of rights-of-way in urban areas where advance planning and purchase are essential to locating substations and supply lines close to load centers. According to R. L. Bortner, Potomac Electric Power Co, this is particularly applicable around growing cities where landowners object to high-tension lines and substations on land held for development or sought for parks or roads.

Bortner advocated buying such rights-of-way in fee, rather than as easements, well in advance of actual need. This practice pays off in prevention of encroachment, freedom to change facilities, and protection against loss by tax sales. "You get more for your money when you buy the fee title and . . . in an urban area there is no difference between the cost of a fee and the cost of an easement," he summarized.

As long as the utility has a definite and logical plan for use of the property, Bortner said, the courts permit condemnation years before completion. He cited PEPCo's 75-acre Oak Grove Substation site six miles outside the District of Columbia which was purchased in 1958 for construction to start in 1962. Securing additional acreage to permit screen planting helps to guard against neighborhood protests, he said.

Rights-of-way should be bought with width for future lines, said Wylie Johnson, Alabama Power Co. His company's practice today is:

- Buy 50 ft for a single 44-kv line; 75 ft for two lines.
- Buy 80 ft for a single 110-kv line; 140 ft for two lines.
- Buy 100 ft for a single 230-kv line; 175 ft for two lines.

Operating problems confronting utility management in the fields of generation, transmission and distribution were met head-on by G. C. Rawls, president, Louisiana Power & Light Co. To handle power plant automation, his company plans to have a 230-Mw unit in operation early next year at Little Gypsy Plant that will be capable of fully automated operation. "Although we know we can do this," said Rawls "the problem is to tell the computer what to do." Reliability of automated operation was underscored with the report that the installation at Louisiana P&L's Sterlington Plant turned in a 99.67% "on the line" operation for six months.

Evaluates Tubular Poles

To meet pressures for more pleasant looking transmission structures for city streets, Rawls described three types of metal structures for 115 kv and above: Hollow steel poles; an aluminum truss-type, free-standing tower designed to carry 1,000-MCM aluminum conductors in a 125-knot wind; and a new 85-ft tapered, octagonal, welded-aluminum pole. Colored slides illustrated the "disappearing quality" of a line of metal poles, as compared with conventional wood frames, when viewed against a clear sky.

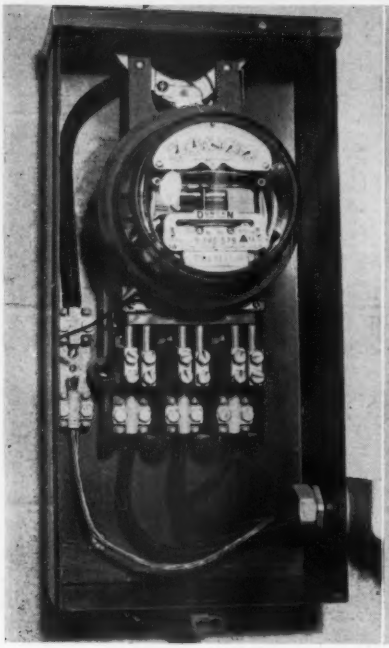
Aluminum poles carry 230 kv . . . *Rawls*

To preserve the value of older linemen, both for themselves and the company, Rawls said that further mechanization of distribution construction equipment is essential. Mechanized equipment reduces the physical labor, increases productivity, and enhances the safety aspects of the work.

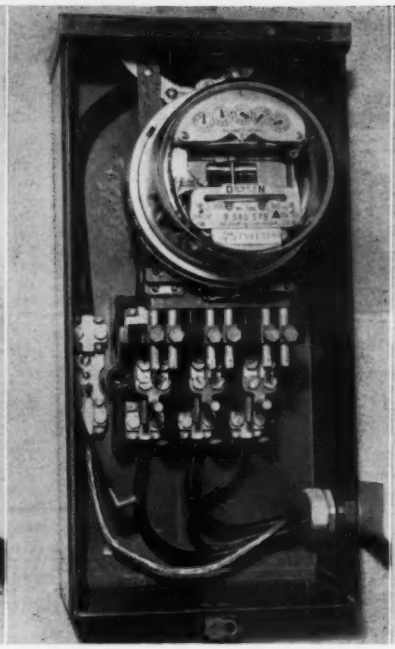
There is no provision in the rate structure for either (1) the higher quality of service deemed essential for the all-electric home or commercial and industrial customers that simply have to have continuous service, or (2) the move to underground residential service being led by the telephone company. But these two operating problems in distribution must be solved, Rawls said, adding that a better quality of residential service can be provided by newly-designed single phase distribution laterals fed from a modern, shielded three-phase feeder.

Results show that new system-planning techniques give the distribution system planner the tools and decision-making guides, heretofore unavailable, that will assure the optimum development of distribution systems. These digital computer-based techniques, reported David N. Reps, Westinghouse Electric Corp, are especially important in the planning of distribution facilities, which involves a great number of individual system components.

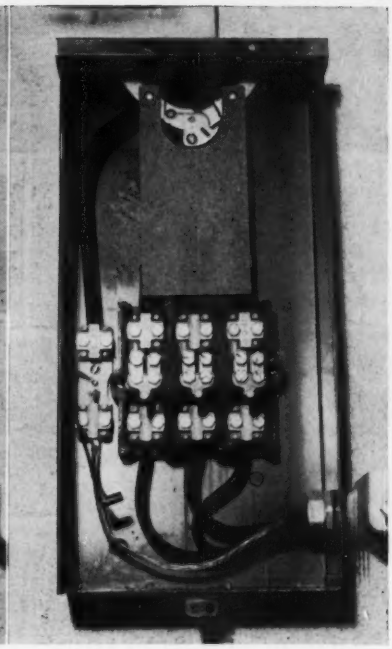
(*Continued on page* 90)



200-AMP 'B' METER and enclosure is a 3-phase, 4-wire installation



METER, shown in test jack, has jumpers to maintain service



REMOVAL of meter is accomplished without interruption to customer

'B' Meter and Enclosure Solve

Bring Detroit Edison savings at no sacrifice in convenience, flexibility, testing and maintenance safety

T. A. DAHLKE, Senior Staff Engineer, Meter Department, Detroit Edison Co, Detroit, Mich.

Many polyphase metering problems have been solved economically by Detroit Edison Co through the use of the "B" meter and enclosure. Such polyphase metering effected a substantial saving over previous practices without sacrificing convenience, flexibility, or safety in testing and maintenance. The problem was solved by two meter enclosures and a current transformer enclosure, all for indoor or outdoor metering.

Metering Keeps Pace

Over the years single-phase, self-contained metering has kept pace with residential and commercial load growth. A four-jaw, heavy-duty socket in conjunction with the Class 200, single-phase socket meter has made 200-amp single-phase metering practicable, simple, and economical. The increase from 100 to 200 amp, single-phase, self-contained metering resulted in substantial savings to utilities and their customers.

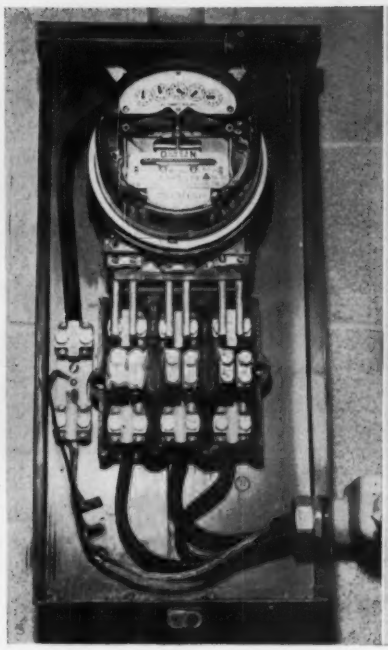
Self-contained polyphase metering in the 100 to 200-amp range, however, has been more of a problem than self-contained, single-phase metering in the same range. This was because of the more complicated meters (additional stators and internal wiring) and additional external wires and connections. The "A" base meter does not lend itself to heavy-duty, self-contained installations. The temperature rise caused by the many contact joints at the meter and connection block, is excessive and the meter terminals do not accept wire sizes larger than No. 1 AWG.

The "S" polyphase meter, in conjunction with a heavy-duty socket, provides self-contained metering up to 200 amp. Yet, because of the meter design, connections between meter blades and socket jaws must be made without visible wiring of the "A" base meter. This disadvantage, not too serious in single-phase metering, becomes definite in polyphase socket metering.

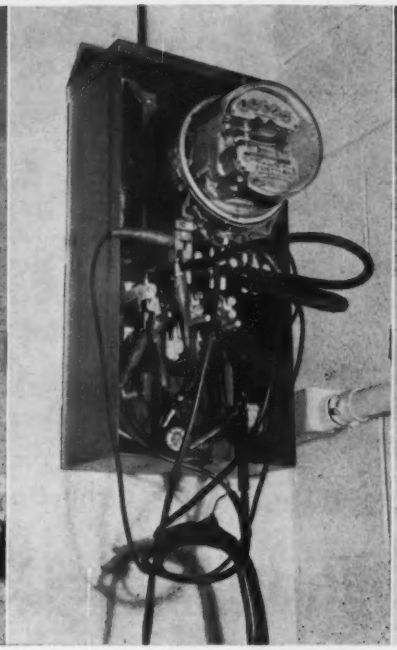
Inserting or removing a polyphase, Class 200 socket meter becomes difficult when the socket has heavy-duty jaws. Installers sometimes spread the jaws to relieve the tension, inadvertently reducing the ampere capacity of the installation. This insertion problem can be eased by the use of complicated clamping jaws, at an additional cost, and by some sacrifice of trough space.

Has Disadvantages

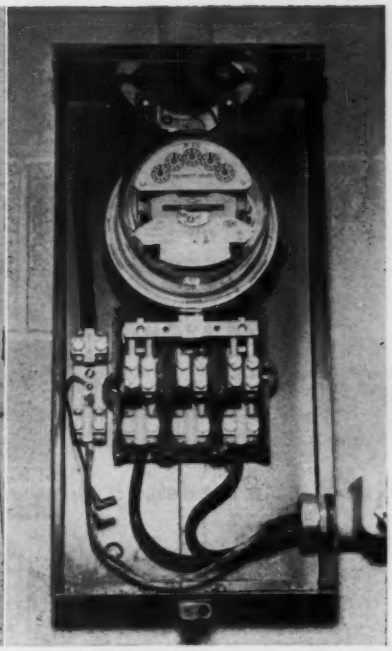
The polyphase socket meter, although it extends self-contained metering to 200 amps, does not provide some desirable features of "A" base polyphase metering. Some utilities seem reluctant to change from "A" base to "S" base polyphase metering. The inherent "S" base hidden connections make by-passing for test



METER is here disconnected, current coil extensions protruding



METER is readied for testing without interruption to the service



CONNECTED for single-phase, fourth wire is pulled in but unenergized

Polyphase Metering Problems

and maintenance difficult, awkward, and practicable only with special tools. Yet by-passing is usually desirable.

The new "B" meter and enclosure design offers the same accuracy characteristics as the "A" and "S" meters and capably handles 200-amp loads with self-contained metering. Six ¼-in. dia terminals, extensions of the current coils, protrude from the bottom of the "B" meter. This terminal design permits the use of an enclosure with a front-connected connection block, so that connections at the block are simple, effective, and visible. The "B" meter, like the "S" meter, needs no additional wires between meter and connection block. Both of these meter designs result in similar thermal characteristics.

The "B" meter affords substantial savings in investment costs by making possible the use of self-contained, polyphase metering on installations having up to No. 4/0 AWG copper service entrance conductors. Previously, loads between 100 and 200 amp required CT's with the proper enclosures, and test switches. "B" metering equipment is wired simply, like "S" polyphase metering. Its installation requires no special tools and allows meters to be by-passed, replaced, or left disconnected. The simple enclosure and block construction results in a very competitive device (approximately $25) that provides a maximum of trough and working space.

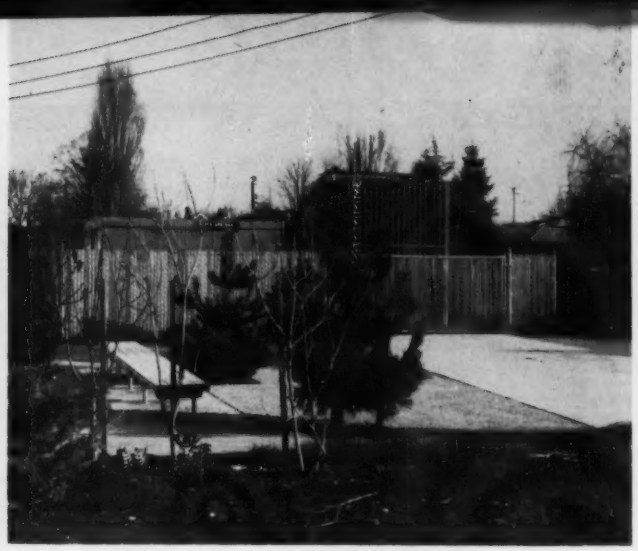
Enclosure Developed

A 100-amp enclosure was developed for No. 8 to No. 2 AWG copper service entrance conductors to permit uniform practice and provide maximum economies. It has all the features of the class 200 enclosure, except load-carrying capacity, and costs about $12.

Use of the "B" meter has also been extended to installations over 200 amp, using a Class 10 meter and CT's. This meter, built to the same external dimensions, has the same internal and external connections as the Class 100 and 200 "B" meters. The secondary wiring interconnects the primary and secondary windings of each CT on the service side to obtain meter potential. The CT's do not have a common return. These installations use the standard 100-amp "B" enclosures and block, instead of an expensive test switch. This installation permits the meters to be tested in the same way as self-contained meters, by hanging the meter in the disconnect position in the enclosure, or by using a simple test jack.

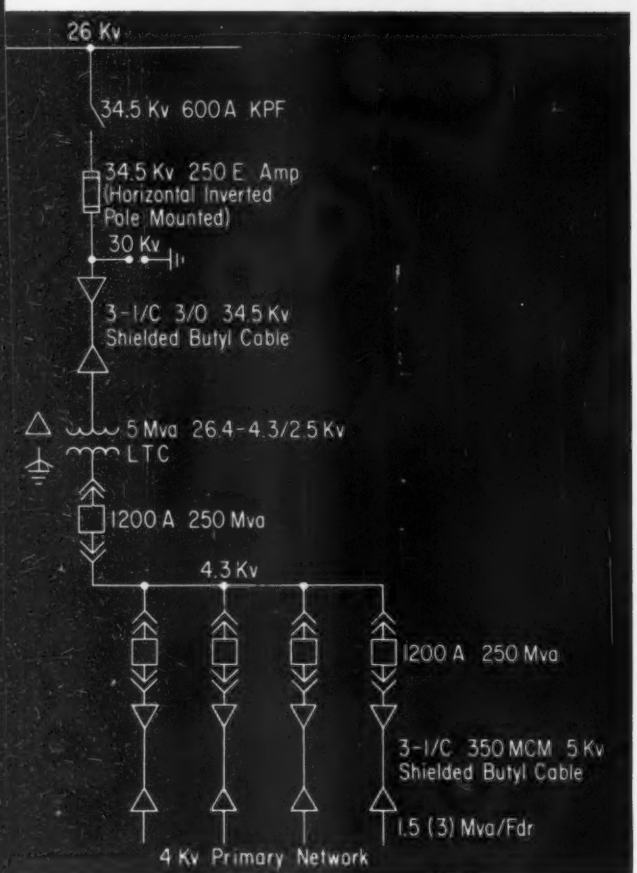
A few self-contained, commercial metering installations have four-wire service entrance conductors brought into the meter enclosure, even though the customer initially requires only single-phase service. This problem is handled with no difficulty by attaching a commercially available adapter to a single-phase "S" meter, which converts it to the equivalent of a "B" meter.

When the four-wire service is needed, the single-phase meter with the adapter is replaced by the proper "B" polyphase meter. Such single-phase metering is not intended for normal single-phase, self-contained installations.



Using scale models to show residents . . . how architectural treatment makes . . .

Seattle Finds Esthetic Substations



TYPICAL RESIDENTIAL DISTRIBUTION substation used by Seattle City Light has 3,000, 5,000 or 6,000-kva metal-clad unit. Such subs are spaced about one per square mile

LEON A. HARMON, Associate Electrical Engineer, Seattle City Light, Seattle, Wash.

Decreased opposition to new residential distribution substations and public plaudits from the City Council and Planning Commission are striking evidence of the success of a Seattle City Light program to blend esthetics with engineering in residential substation design.

A professional architect prepares landscape drawings for every new substation planned for a residential area. Aim is to eliminate the industrial look through proper use of spaces and materials, and to direct attention to the property as a park and play area that enhances the community. In addition, low noise level transformers are used, the incoming line is run underground, and the number of poles near the substation is reduced.

With an average annual residential use of over 8,000 kwhr, Seattle is considerably concerned about substation appearance in well-developed residential areas. Since 1945, 130 metal-clad unit substations, rated 26.4—4.3 Y/2.5 kv, have been installed, spaced about one per square mile. Typical sizes are 3,000, 5,000 and 6,000 kva.

Terminal Tower Eliminated

Prior to the "new look," the usual layout included a unit substation, a 35-ft steel transmission terminal tower, underground 4.3-kv feeders and equipment. A 7-foot chain link fence with barbed wire on top, enclosed the substation. Landscaping ranged from little to a screen of shrubbery planted along the fence.

In 1957, under a new zoning ordinance, the City Planning Commission began to exert more influence on the over-all appearance of proposed substations, especially toward elimination of the terminal tower. As a result, the past year has seen radical design changes, requiring a more imaginative approach to site development and a substitute for the terminal tower.

Now, when a substation is planned, the architect is

substation useful . . .

and beautiful . . .

Effective Public Relations Tool

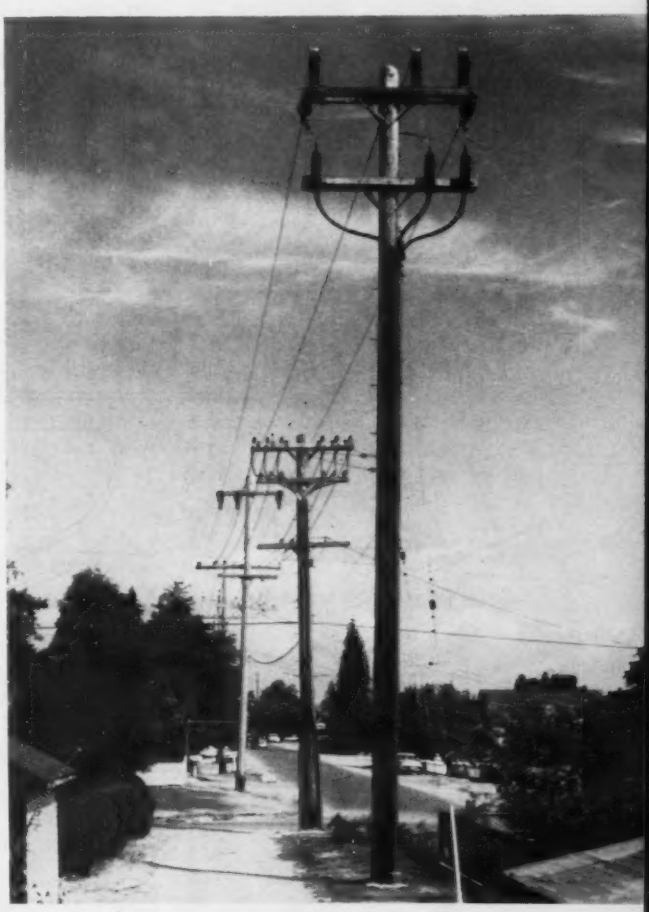
given several design parameters to fulfill, such as equipment and service areas required and minimum set-backs from property lines. An artist's conception of the landscaped property is provided for a public hearing. If necessary, a model—which is more easily understood by the general public—is prepared. The architect's fee has been nominal, generally around $100. When both renderings and models are necessary fees range from $300 to $400.

The six substations so far developed in this way have been well received by the public. The City Planning Commission and the City Council have complimented the Lighting Department at public hearings. Opposition to proposed substations has decreased significantly in recent months.

Transformer Sound Level Reduced

Changes also have been made in substation equipment. Transformers with a sound level averaging 5 db below standard have been used. The subtransmission line is brought in underground, with the high-side disconnect switch, fuses and lightning arresters mounted on normally space poles in the street. To avoid a "forest" of poles in front of the station, these same poles are used for 4-kv and 26-kv potheads. All equipment is painted a forest green to blend with the landscaping, and 4 to 6-ft decorative fences are installed. For protection of the public, all doors on the switchgear are mechanically interlocked and are padlocked at one point. This also provides easy access by service personnel. Transformer tap changer doors are locked separately.

What is this costing the utility? Landscape architectural features and plantings may cost from $2,000 to $4,000. Bringing in subtransmission underground adds from $3,000 to $4,000 to cost of a steel tower termination. But City Light management feels that the results in better customer and community relations are well worth the additional expense.



NORMALLY SPACED POLES near sub have 34.5-kv pothead on first pole, 4.3 kv feeder terminations on second, 34.5-kv fuses on third, high side disconnect on fourth

Developers Like Underground

Share installation costs with PGE to obtain real estate selling feature, initiating new trend in urban service

DOUGLAS C. WHITE, Assistant Superintendent, Outside Division, Portland General Electric Co, Portland, Ore.

Real estate developers in the area served by Portland General Electric Co insist on underground service now that they have found it an attractive feature in selling a home. They feel that installation charges are reasonable and that PGE's conditions and requirements are equitable.

PGE is acting on the premise that this is the beginning of a radical change in urban distribution and is proceeding with caution, making sure that installations are safe, adequate, and reliable. Although overhead service will continue to be provided for many years, it will gradually disappear in more congested areas. All new areas will be served by underground distribution systems within a very few years. The need for improved service continuity will hasten this trend.

Nearly ten years ago PGE initiated underground service to residences, using a transformer housing of sewer-tile-type, semi-buried base with a metal top. About 100 homes are now served in this manner. The vaults proved expensive to build, have a tendency to fill with water when it rains, and difficult to work in and around.

Provides Answers

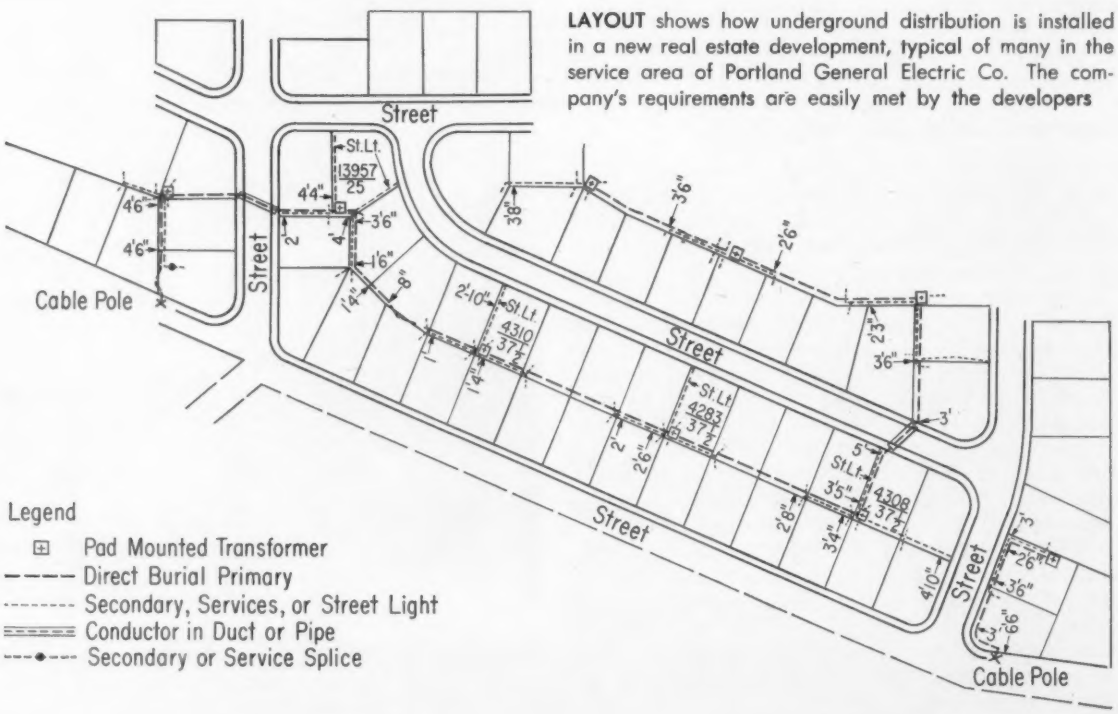
The pad-mounted transformer, however, provides some answers to the many problems and provides incentive for proceeding with this construction. PGE has developed rather complete plans and specifications, though they are subject to continuing change.

Underground now serves ten trailer courts, several commercial 3-phase installations, and numerous multi-family dwellings. During 1959, 100 pad-mounted transformers—7,686 kva total—were purchased, representing about 7½% of distribution transformer expenditures for the year. This proportion is expected to be nearly 20% in 1960.

The usual rates and tariffs for overhead service are applicable to underground. The main difference to the customer is the requirement that he dig and backfill the service trench to PGE specifications and contribute the difference in cost between that of underground and overhead construction. In arranging for payment of the cost difference, each job is discussed with the developer. The amount has averaged $147 per lot over 14 subdivisions. Ultimately, a fixed charge per lot front-foot may be established.

Authorization to proceed is given by letter from the developer, which reads as follows:

"Please consider this letter as my request and authorization for Portland General Electric Co to furnish underground electric service, including underground house service for "x" number of residential building



LAYOUT shows how underground distribution is installed in a new real estate development, typical of many in the service area of Portland General Electric Co. The company's requirements are easily met by the developers

Distribution

sites which comprise all of "y" subdivision located in the vicinity of "A" and "B" Streets.

"I agree to pay Portland General Electric Co a total of "n" dollars, which consists of "M" dollars for each building site included in the agreement. Payment in full is to be made after installation of the primary underground system and before connection of any underground house service. After payment, and upon reasonable notice by me, the underground house service shall be installed by Portland General Electric Co without further cost to me.

Easements Furnished

"I agree to provide and backfill a trench as per your specifications for the service wires from the back lot line to the house service entrance in this subdivision. I will furnish such easements as may be required by Portland General Electric Co."

Normally, PGE constructed underground residential systems on the back lot lines of new subdivisions. This avoids future service runs under street areas, conflict with sewer and water mains, and future trouble or damage due to traffic. The primary and secondary circuits, transformer locations, and multiple street-light circuits are covered by a recorded easement 5 ft or greater in width or by a utility reservation in the original plotting of the subdivision area.

Before construction, PGE determines where all other utility lines are going to be placed and the grading of the area, and makes complete plans for the installation of its own equipment. Complete agreement with the telephone company concerning installation of its cable above PGE's in the same trench is important. Conductors must be large enough to serve any load anticipated.

Most of the work last year was done by contractors and required PGE to get specifications out to five or six prospective bidders. PGE has placed a recent graduate engineer in the field to inspect the work, to advise the contractor, and to keep accurate record of equipment on the jobs.

Potheads and stress cone were made by PGE's own crews, who also made splices and transformer connections. Normally, the transformers and high-voltage cable are furnished by the company and remaining materials by the contractors.

PAD-MOUNTED TRANSFORMER provided answers to many problems in installing underground service. Primary connections, unconnected service are shown

Before installation of the precast transformer pad, the area beneath it must be excavated to 18 to 24 ins. Adjacent trenches are backfilled with sand or pit-run gravel. The precast pad is then put in place, leveled, and the transformer installed. Without this type of backfill experience has shown that the pad and transformer may tilt after installation.

The transformer pad is a precast reinforced concrete pad 52 by 57 by 4 in. with an opening for conductor entrance, and provision for ⅝-in. removable eye-bolt for lifting and two ⅝-in. hold-down bolts for the transformer.

Service trenches 3 ft deep are dug by the building owner or subdivider and are backfilled by him

COMMERCIAL INSTALLATIONS are characterized by their clean lines

MULTIPLEX APARTMENTS can be served practically in manner shown

PRIMARY CABLE is placed in a trench by the truck with the reel which is driven along a route parallel to the trench

FIBER DUCT and conductors are placed in the machine-dug trench before backfilling and pad building

after PGE has installed the service drop and made necessary connections. The main line primary trenches are dug by a trenching machine which normally digs a trench 8 in. wide and 52 in. deep.

Low-voltage wire is placed at the 3-ft level, 4 in. of sand, 4 in. of earth, 4 in. of sand. The telephone company places its cable at 18-in. level, 4 in. of sand, and the rest of the trench is backfilled with earth. The sand may be omitted in soils free of rock. Rigid conduit is required at all street crossings and other locations where water or sewer utilities are planned to cross the cable.

The pad-mount transformers are placed so that the rear of the concrete pad is 3 in. from the rear lot line and the side 12 in. from the side lot line. This puts the pad on the 5-ft easement and allows access to the transformer doors from the street.

Services are installed directly from the pad-mounted transformer or the secondary to the entrance at the rear of the house. Three types of stranded secondary or service cables for direct burial are used:

No. 2 stranded copper conductor type USE, 600-v, 4/64-in. rubber insulation, 3/64-in. Neoprene jacket rated at 180 amp.

No. 2/0 stranded copper conductor type USE, 600-v, 5/64-in. rubber insulation, 4/64-in. Neoprene jacket rated at 259 amp.

And 250-MCM stranded copper conductor type USE, 600-v, 6/64-in. rubber insulation, 5/64-in. Neoprene jacket rated at 363 amp.

Service equipment is simply inverted from the normal installation for overhead service. Instead of the usual service weatherhead the service extends through the footing of the house and terminates in a bushing at the end of the service conduit. The tail of the customer-owned underground service conductor is designed to extend beyond walkway or other obstruction.

Multiple street light conductors are adjacent to the side lot line from the rear of the lot to street light locations. For this purpose PGE uses No. 8 solid copper conductor type USE, 600-v, 4/64-in. rubber insulation, 3/64-in. Neoprene jacket which is rated at 84 amp for direct burial.

Splices Described

Secondary and service splices contain copper compression connectors and taping to a thickness of 1½ times the insulation thickness and lapping over the wire insulation. The tape is a soft self-binding type of polyethylene or Neoprene, and after the splice is made it is laid directly in the ground.

The primary layout is usually single-phase, 12.5-kv-wye with the provision that it may be looped so that any section of the primary circuit can be removed from service without customer blackout. PGE tries in the beginning to locate a 3-phase overhead feeder circuit near the subdivision.

The high-voltage cable is a standard No. 2 single-conductor stranded copper, 15-kv grounded neutral, shielded direct burial cable with 19/64-in. butyl rubber insulation, 0.005-in. tinned copper shielding tape, 5/64-in. Neoprene jacket, and 17 wires of No. 14 copper concentric neutral overall. The high-voltage terminations on poles have regular compound-filled potheads. The high-voltage terminations at the transformer are made according to manufacturer's specifications for an indoor stress cone terminal for shielded cable.

PGE feels that it has made a good start toward its goal of an economical, safe, and reliable underground electric distribution system.

It is sometimes difficult to get developers to tie down the final grade on a project early enough so that PGE can get its equipment installed in time to have electric service for construction. This has resulted in the installation of some expensive temporary services.

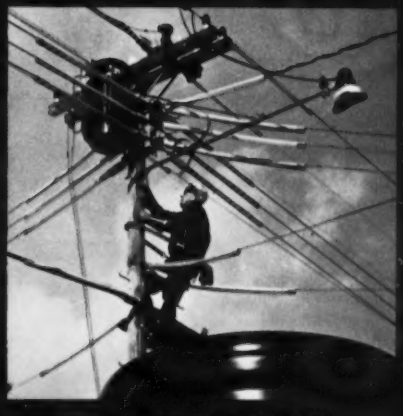
Another problem is the conflict with sewer and water line crossings. If these are in first, PGE must be careful not to damage them.

In planning PGE strives to provide routes for future transmission lines and heavy feeder circuits overhead. For example, it has an overhead 3-phase feeder on the north and east borders of a new 500-home subdivision. This will be useful, as plans for a shopping area, multiplex dwellings, and schools are developed.

GENERAL ELECTRIC ANNOUNCES...

A NEW METHOD OF TRANSFORMER RATING

DEVELOPED SPECIFICALLY TO LET YOU TAKE FULL ADVANTAGE OF THE BENEFITS OF GENERAL ELECTRIC'S PERMALEX INSULATION



DISTRIBUTION TRANSFORMERS

NETWORK TRANSFORMERS

MEDIUM TRANSFORMERS

General Electric's new rating method gives you higher kva ratings, with full operating life, at no extra cost.

GENERAL ELECTRIC

Using General Electric's new transformer rating method, you utilize

Greater kva capacity with Permalex* insulation

Permalex insulation was developed in G-E laboratories, and reported to the industry in AIEE paper TP-60-58 over a year ago. But standard rating systems have not permitted some users to fully realize the benefits of this outstanding insulation system — until today.

Now General Electric announces a NEW method of rating transformers, specifically designed to let you take maximum advantage of the higher kva capacity possible with Permalex insulation.

An additional higher kva rating now appears on G-E oil-filled distribution and network transformers.

*Trademark of General Electric Company

GENERAL ELECTRIC'S PERMALEX insulation gives you more kva — at lower cost-per-kva. Photo at left shows new 55° @ 65° label which identifies G. E.'s new dual-kva distribution transformer.

For example — a transformer formerly rated 25 kva is now rated 25/28 kva — indicating that you get the full benefits of a 28 kva unit from a General Electric transformer ASA-rated at 25 kva.

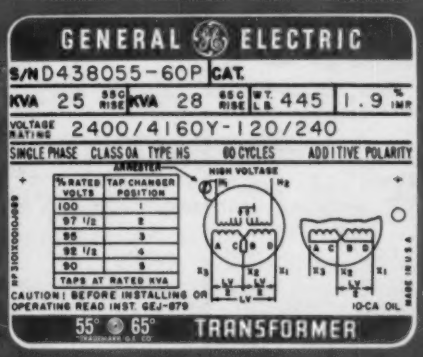
The nameplate is labeled 55° ● 65° to show the corresponding average winding rises associated with these two kva ratings. Here are sample ratings: 50 kva is now 50/56; 250 kva is now 250/280; and 750 kva is now 750/840 kva. Permalex insulation enables you to base your transformer utilization on the higher load and temperature with no sacrifice in transformer life.

Using the new higher kva rating, you can now apply the full benefits of Permalex insulation *according to your established loading practices.* Since you get more kva capacity at no price premium, you can realize substantial savings on cost-per-kva.

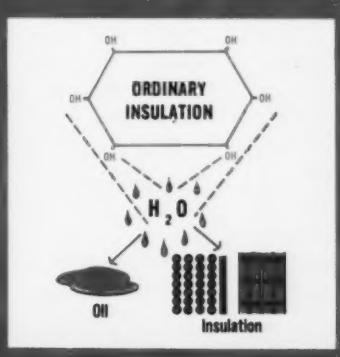
Your General Electric Sales Engineer can give you a dollars-and-cents breakdown of the actual savings *you* can get. Contact him today, or write for bulletin GEA-7047 to Section 482-05, General Electric Company, Schenectady 5, New York.

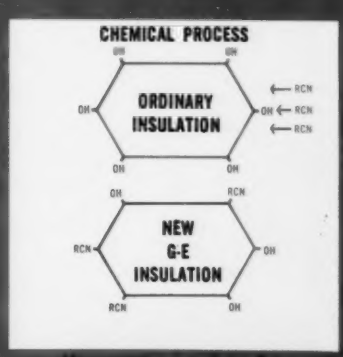
GENERAL ELECTRIC

NEW NAMEPLATE shows ASA standard 55C rise kva rating, plus General Electric's new kva rating based on 65C rise — made possible by Permalex insulation.



HERE'S WHY Permalex insulation allows transformer operation at 65C winding rise. Chemically modified insulation in G-E Permalex system drastically reduces formation of water which attacks turn and layer insulation in ordinary systems.





FULL-VALUE
CERTIFIED
TRANSFORMER
GENERAL ELECTRIC

- Superior design, features, and performance
- Faster shipment
- Complete service

HERE ARE THE NEW RATINGS

	55C Self-Cooled	65C Self-Cooled	65C Fan-Cooled
1φ	833 kva	933 kva	1073 kva
	1250 kva	1400 kva	1610 kva
	1667 kva	1867 kva	2147 kva
	2500 kva	2800 kva	3500 kva
	3333 kva	3733 kva	4666 kva
	5000 kva	5600 kva	7000 kva
3φ	750 kva	840 kva	966 kva
	1000 kva	1120 kva	1288 kva
	1500 kva	1680 kva	1932 kva
	2000 kva	2240 kva	2576 kva
	2500 kva	2800 kva	3500 kva
	3750 kva	4200 kva	5250 kva
	5000 kva	5600 kva	7000 kva
	7500 kva	8400 kva	10500 kva

Permalex insulation now used in G-E medium transformers

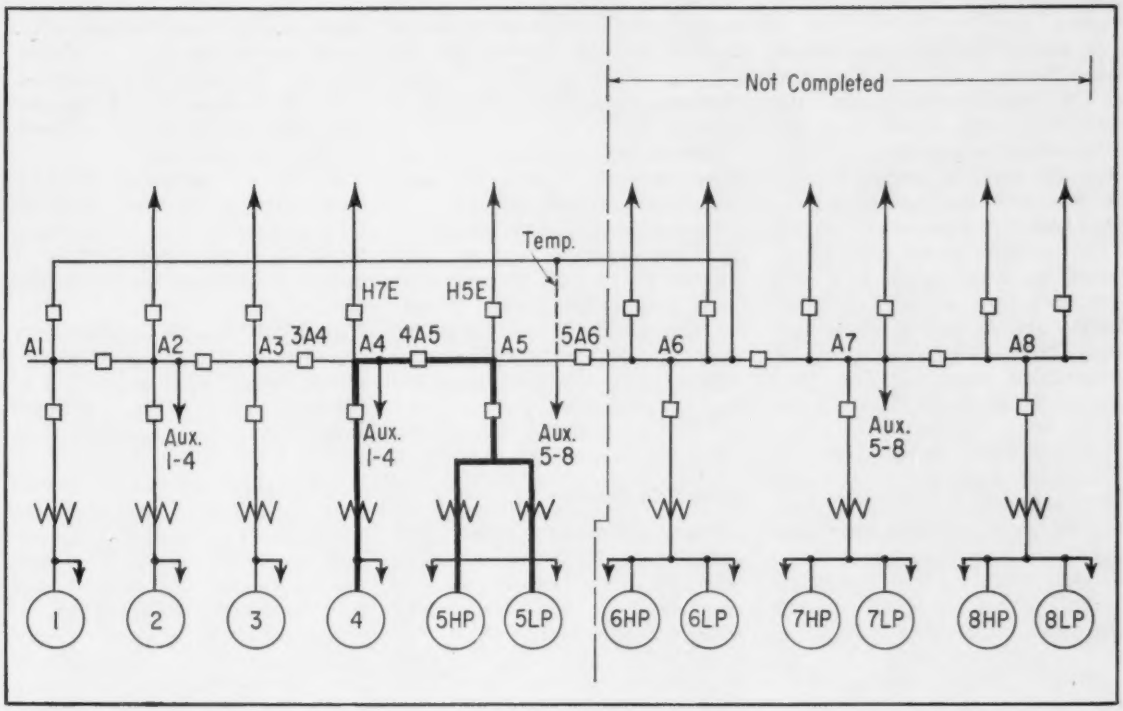
General Electric now extends the use of Permalex insulation to medium transformers to give you 12 percent higher kva with continuous operation at 65C rise. You get this bonus kva at no price premium — and with no loss in transformer life expectancy.

For example — a G-E medium transformer with Permalex insulation, formerly rated by ASA at 5000 kva, 55C rise, can now be operated at 65C rise and 5600 kva with normal life. If you operate the transformer at ASA rating you get five times longer life. In addition, standard fan-cooled rating increments can be applied at 65C rise operation.

Your General Electric Sales Engineer has specific information on the savings you can realize with the new higher kva ratings — another Certified Full-value feature of General Electric medium transformers. Give him a call, or write for detailed information to Section 482-05A, General Electric Company, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC



ONE-LINE DRAWING shows main connections for operating generator uncoupled from steam turbo-generator unit to serve as synchronous condenser for supplying Toronto reactive on a system which is predominantly hydraulic

Uncoupled Generator Gives Kvar

Component of steam turbo-generator unit at Toronto station operates alone as an economic condenser

H. T. DICKSON, Electrical Engineer, Stone & Webster Engineering Corp, Boston, Mass.

The generators of modern steam turbo-generator units have been operated profitably by the Hydro-Electric Commission of Ontario as uncoupled synchronous condensers without special provision having been made in the unit's original design.

Although this predominantly hydro system does not need thermal generation for several months, remote hydraulic generation alone cannot furnish large blocks of kvar for the heavy loads around Toronto. Reactive for system stability is preferred from synchronous machines, rather than from static capacitors. Accordingly, four 100-Mw turbine generator units installed in 1951-1953 at Toronto's Richard L. Hearn Station have operated as steam-cooled synchronous condensers. But the expense of steam generation prompted a proposal to operate the generator uncoupled, a procedure originated at the commission's J. Clark Keith Plant.

After Unit 5, a 200-Mw cross-compound machine, was well under construction, the commission found that clearance would be available for generator rotor positioning bearings. Serious thought was then given to temporary condensing operation of the generator uncoupled from its turbine until units designed for this service were available.

As special amortisseur windings and other special provisions for starting had not been included, the commission planned to use the adjacent 100-Mw steam turbine generator as the prime mover. This machine, accordingly, was connected electrically to the terminals of the new unit by way of the generator unit step-up transformers and an isolated section of the high-voltage bus.

Such starting demands controlled excitation of the driving generator and the two components of the driven machine at all speeds up to rated speed. The 200-Mw unit has two motor-driven exciters, one for each rotor, so that this machine posed no problem. But the 100-Mw generator depended upon a shaft-driven exciter, useless at low speeds.

Fortunately, a spare motor-driven exciter was available, and temporary arrangements were made to connect it to the No. 4 field breaker

after disconnection of the direct-connected exciter and removal of its brushes.

As both turning gear mechanisms of No. 5 operate on the turbine side of the generator couplings, the rotors had to be started from rest as asynchronous machines. To minimize the required starting torque, the generator bearings were provided with high-pressure jacking oil.

But auxiliary power supply was a problem. The original four 100-Mw units are supplied from a 2,300-v station service power system. The station extension under construction, comprising four 200-Mw machines, has 4,160-v service for the larger auxiliaries.

Thus, the only power source for No. 5 exciters and other auxiliaries before completion of Units 6, 7, and 8 is the start-up transformer connected to the high-voltage bus section into which the generator feeds. This transformer was reconnected temporarily to another bus section for synchronous condenser starting.

Enough bearing and hydrogen seal oil was supplied by isolating the No. 5 generator oil system from the turbine, such isolation permitting turbine maintenance during condenser operation. Duplicate ac seal oil pumps and turning gear oil pumps reinforced the usual dc emergency pumps, not to meet oil requirements but to assure an uninterrupted supply and to reduce dependence on the station battery. Two independent low-voltage circuits serve the duplicate pumps which run together and are piped in parallel.

Preliminary preparation completed, the No. 5 generators were uncoupled from their turbines, their rotors were backed away, and spherically seated bound bearings were installed to position the generator rotors axially. The turbine oil system was valved off, and the generators were charged with hydrogen. Tripping by loss of field relays was blocked to prevent possible false operation in underexcited regions, and only annunciation was retained.

Motor Too Small

The instantaneous-voltage and current relays for protection during high-speed rotor prewarming were reconnected to permit functioning while the generator breaker was closed. All tripping circuits initiated by closing of the turbine stop valve were blocked, and the stop valve trip solenoid circuit was de-energized.

Several starting procedures were tried to determine the simplest and most positive. All three rotors at rest, with a low value of excitation applied, it was presumed, could be made to rotate from the turning gear of No. 4. But the turning gear motor was too small. Even with a steam assist from No. 4 turbine, the No. 5 rotors only oscillated, probably because No. 4 was not sufficiently excited for fear of burning the collector rings.

Startup was successful with Unit 4 on turning gear, jacking oil having been applied to No. 5's bearings. Steam was then admitted to No. 4 turbine which was run up to 200 rpm.

Both No. 5 field breakers were closed at zero excitation, and No. 4 field was applied and raised to 300 amp as the No. 5 rotors turned and accelerated to near synchronism with No. 4.

The stator circulating currents were fairly high at this time, but decreased to a minimum as excitation on No. 5 was raised in proportion with No. 4 to no-load rated field current. No. 4's speed was increased, and No. 5 high-speed rotor was prewarmed in accordance with standard procedure. The units were then run up to speed and synchronized to the system by closing one high-voltage bus isolating breaker. When No. 4 had been taken off the bus and shut down, No. 5 was left to be loaded as a synchronous condenser.

Lack of turning gear poses no serious problem, even after a warm rotor has been shut down. Turning gear is provided to prevent shaft hogging on cooling. On restarting, hogging could cause damage to the bearings from vibrations and to the turbine blades, where clearances are critical.

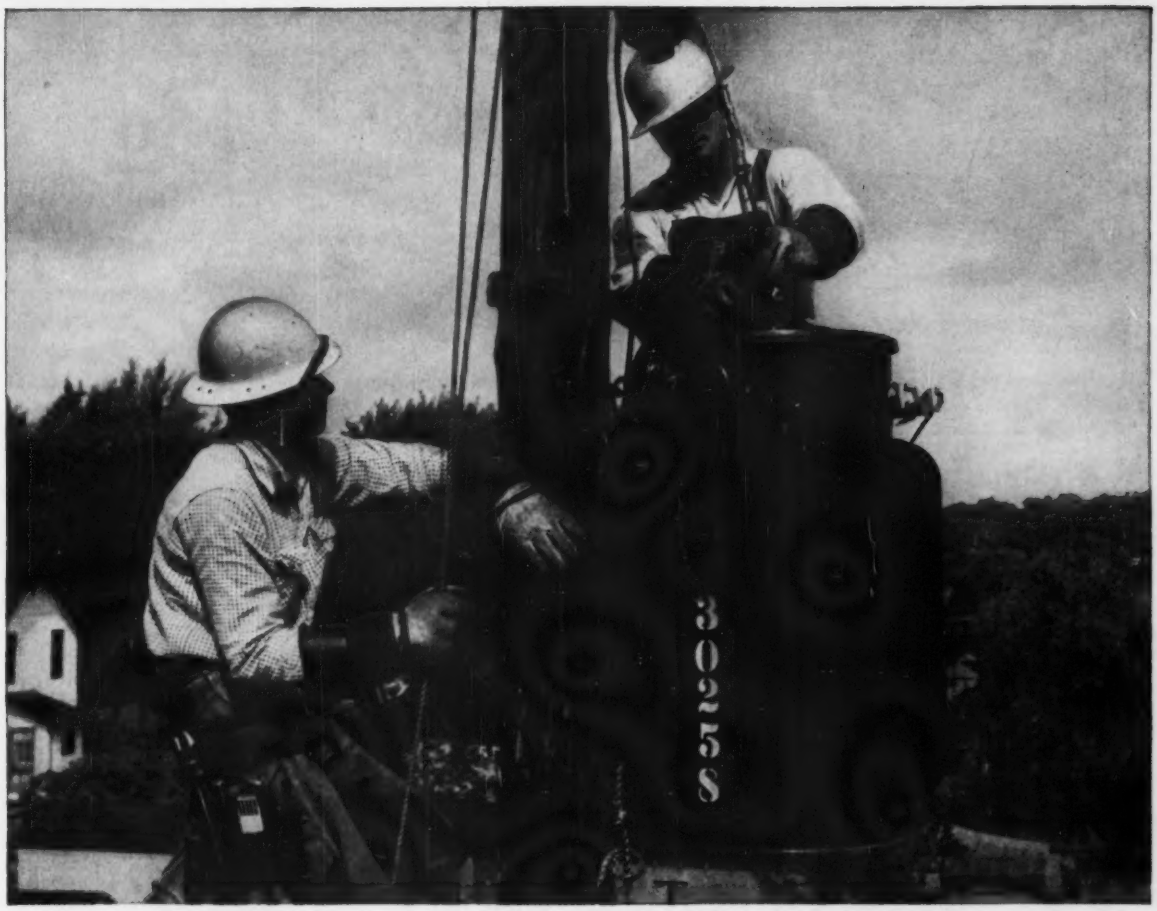
Generator clearances are not close enough to be a problem, and temperatures in the generator rotor are not as high as those in the turbine. When vibration caused by the shaft hogging is considered enough to damage the bearings, the temperature can be equalized by running the rotor at low speed for a few minutes. Running the unit at no load before shutdown obtains more even cooling of the rotor and reduces hogging also. After the unit has been idle about two days, any hogging is corrected.

Units 6, 7, and 8 will use motor-generator acceleration, requiring turning gear on the generator side of the turbine coupling. This will eliminate shaft hogging.

TABLE I—Equipment Data

Generators	No. 4	No. 5 H.P.	No. 5 L. P.
Continuous max. rating, Mw	80	100	100
Power factor, %	80	85	85
Voltage, kv	13.8	13.8	13.8
Speed, rpm	1,800	3,600	1,800
Short Circuit Ratio	1.01	.85	.82
Hydrogen, psi	.5	30	30
Full-Load, Amp	4,184	4,922	4,922
Xd, %	113.2	126	141
XD', %	20.74	19	19
XD'', %	14.37	14	14
No-Load Excitation, Amp	388	710	440
Full-Load Excitation, Amp	835	1,400	910

Main Transformers	No. 4, No. 5 H.P. and No. 5 L.P.
Rating, Mva	80/100, OA/AF
Low Tension, kv	13.2 delta
High Tension, kv	115 wye
Reactance, %	9.52
Exciting Current At Rated Volts, %	1.62
No-Load Losses At Rated Volts, kw	206.6



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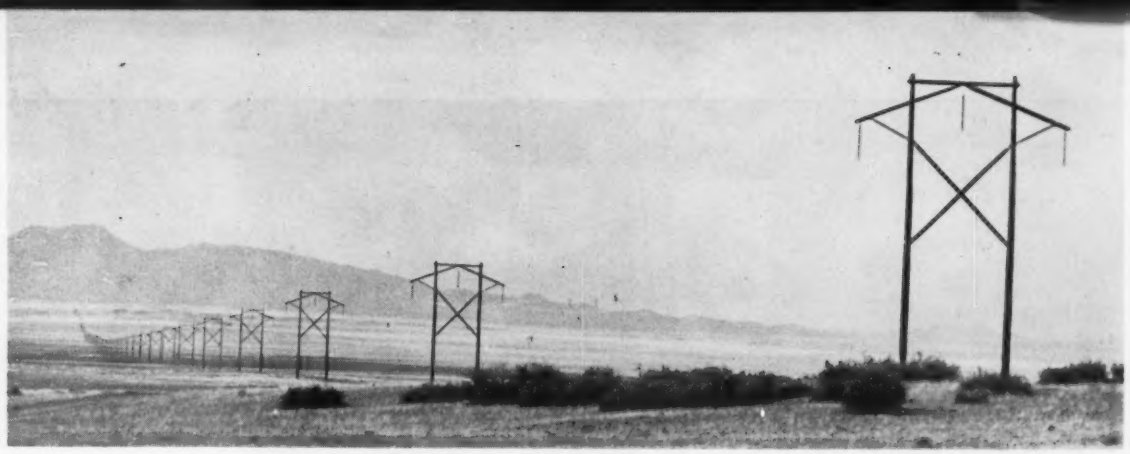

COMPUTATIONS were made for portion of Arizona Public Service's system, a 230-kv transmission line, between Prescott and Flagstaff, Ariz. Use of computer allowed automatic processing of survey notes, other data from punched cards

Computer Spots Towers Cheaply

Digital unit optimizes transmission tower placement and reduces engineering outlays on Arizona PS 230-kv line

V. CONVERTI, Senior Electrical Engineer,
E. J. HYLAND, Engineering Analyst,
D. E. TICKLE, Mechanical Engineer,
Arizona Public Service Co, Phoenix, Ariz.

Savings of $1,000 or more per mile can be realized by using a digital computer to optimize transmission tower spotting, according to recent computations for an existing 230-kv line on the Arizona Public Service Co system. The computer program also reduces engineering costs by 5 to 1 due the computer's ability to duplicate spotting of towers calculated by conventional hand methods at 30 sec per mile.

Other important benefits of digital tower spotting include:

1. Automatic processing of survey notes from a punched card record of terrain coordinates derived from the actual profile and direct input from aerial survey mapping.

2. Economic comparison of alternative routes when several are investigated.

3. Complete computation and tabulated record of tower height, tower span, added weights, tower cost, horizontal and vertical span loading, total cost and cost per ft.

The output of the computer is enough to enable an engineer to complete all his charts regarding location of transmission towers and to order materials for building the structures. Information is also sufficient for cross-checking any loading condition.

Conventional spotting of towers uses a transparent template shaped in a parabolic curve to approximate the catenary curve of the conductor. This method is simulated on the computer by a Cartesian coordinate system of arbitrary origin, such as sea-level and station zero. The equation of the curve is formed and varied as required for moving the axis of symmetry of the curve right or left from a given tower location to determine the proper position for adequate ground clearance throughout the distance spanned. There is a corresponding vertical displacement of the curve with each shift.

Tower Heights Studied

The equation is varied, again, to consider different tower heights at each position. The point of intersection with the ground profile "curve" which lies farthest to the right of Tower No. 1 is the proper location of Tower No. 2.

As the ground profile "curve" is actually a series of discrete points, the computer determines the point of intersection on the basis of differences between "y" values of the conductor curve at a given station number and the actual elevation at the station number. If "y" is less than the elevation, the curve is "underground" (Point No. 1); if "y" is greater, the curve is "above-ground" (Point No. 2). The computer forms the equation of a straight line between two such points and solves it simultaneously with the conductor curve.

Similarly, the equation of the "cold" curve is formed and used to determine vertical span in computing swing-over and up-lift conditions. Where uplift or excessive swingover exists, the computer places an extension on the tower or suspends weights on the insulator string, or both, always taking the least expensive correction. When the situation cannot be corrected with maximum extensions and maximum weights, the tower is dead-ended at a corresponding increase in cost. The computer then accumulates costs for each tower location, sums them for n tower locations, determines the distance spanned by n towers and computes the cost per ft of the towers located.

The above steps represent what is done for just one possible combination of tower heights. When there are m tower heights available and n towers are to be located, there are m^n possible combinations of tower heights. One combination has the least cost per ft. The computer considers each possibility separately, accumulates costs and distance, and retains the combination of tower heights which yields the lowest cost per ft for n towers.

If $m = 5$, one can readily see the difficulties facing an engineer in spotting three or even two towers,

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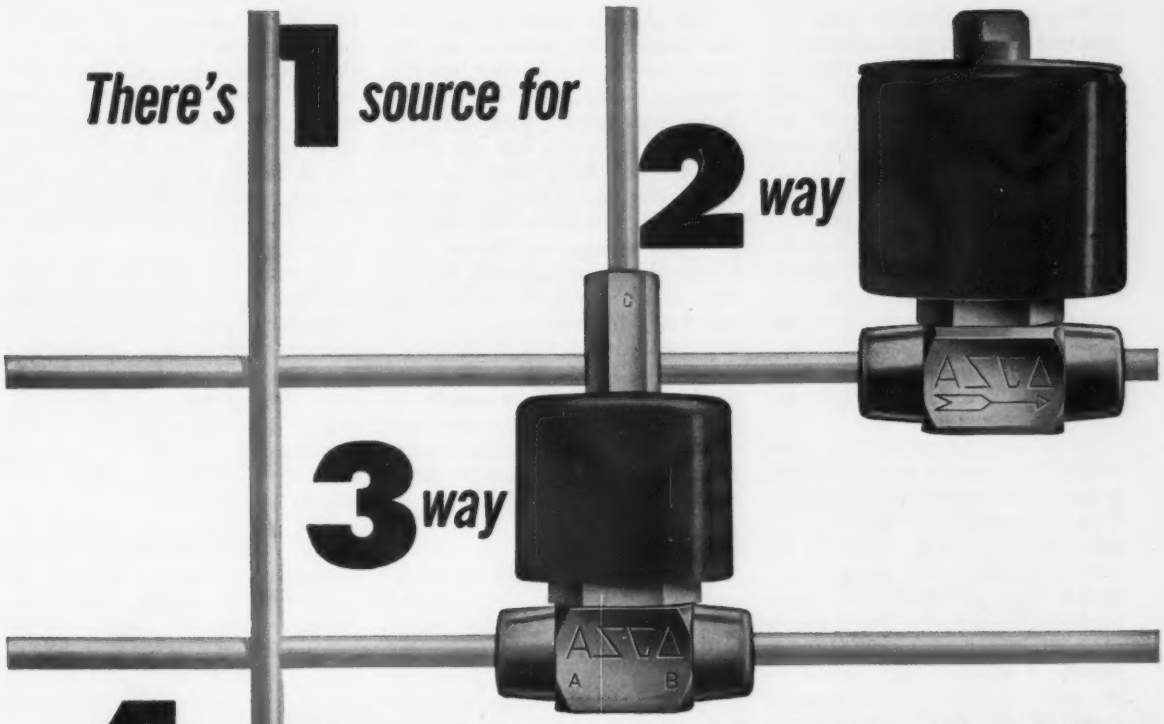
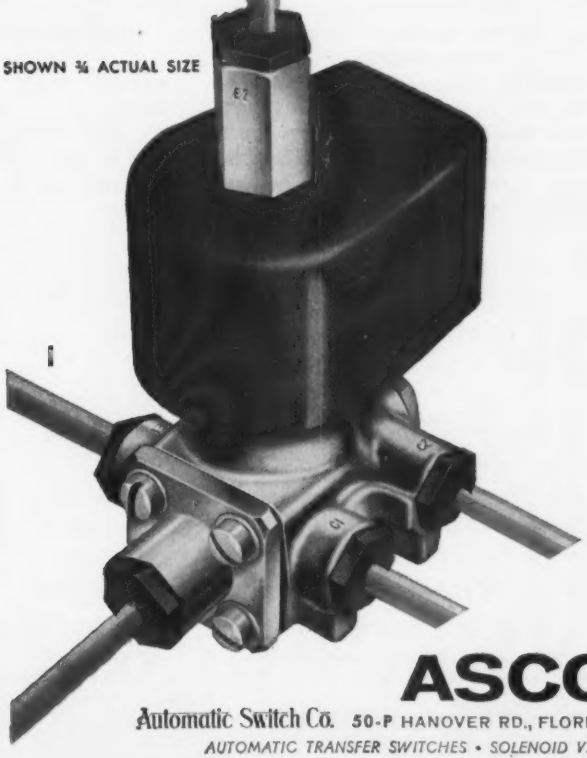


SHOWN ¾ ACTUAL SIZE



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starting from a given position. To spot two towers he must consider 5^2, or 25 possible combinations of tower heights, together with up-lift and swing-over data, cost and distance spanned and select the most economical. Considering 5^5, or 125 possible combinations would be quite impracticable and probably has not been attempted by the conventional method. The computer, on the other hand, considers each possibility and selects the most economical in a little less than 11 sec. When considering 5^4, or 625 combinations the computer selects the most economical in 49 sec.

At present the program operates with either wooden or steel towers without restrictions on voltage or type of conductor. There is a restriction on wooden structures, requiring such to be of a uniform type, such as H-frame. A relatively minor modification permits consideration of both single-pole and H-frame structures on the same line (at 69 kv) and selects the most economical combination. This feature selects the H-frame for those conditions where the span is too great for single-pole. Such conditions are frequently encountered in mountainous terrain or at river crossings. Constants, which vary from one condition to another, are introduced as input or are computed during operation for the existing condition.

Cost per ft was observed to decrease as more combinations were considered. This holds true only within limits, as the machine time for considering the greater number of combinations also increases.

The greatest potential for error was encountered between the Nth tower and the $n+1$ tower, the first tower in the next pass of n towers. A condition can well exist where the computer places the nth tower 200 to 300 ft in front of a river crossing. The river crossing may require that a tower be placed on the edge of the bank, which would be too short a span from the nth tower. Generally, taller towers would be used and the tower would be placed on the river bank rather than 250 ft short of it. To minimize this potential for error, a foresight feature was added which permits the computer to determine the most economical n towers, but then select a fewer number $(n\text{-}k)$ k being variable.

Four Is Optimum

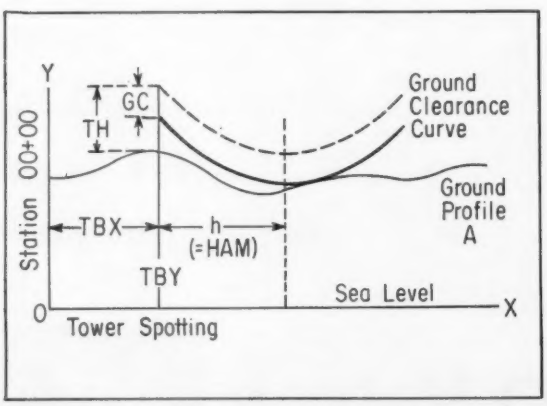
To prevent placement of towers on a roadway, in a river, or some such awkward place, and to ensure clearance over other wires, etc., false elevations at those points are introduced into the computer. These automatically avoid the areas in question. A similar means is used to place angle-point towers precisely on the proper stations.

The optimum number of towers to be spotted in one pass (m^n combinations), considering economies secured and time on the computer, was found to be four. Of the four only two were selected, saving about 10% of the "as built" cost. This required consideration of 625 combinations, then selection of only two towers, and continuation in this fashion to the end of the trial run. The computer spotted towers at the rate of 30 miles per hr with this optimum condition. A fast pass through the same route, with savings of about 8%, was made at the rate of 150 miles per hr. The above times were valid for a 1,200-ft ruling span. For an 800-ft ruling span the rate would be 20 miles per hr for optimum and 100 miles per hr for a fast scanning run.

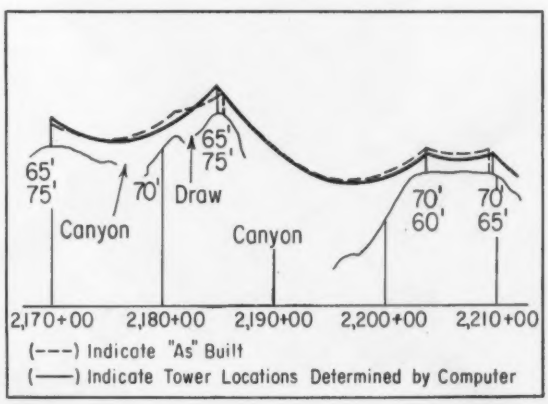
A comparison between "as built" and the most economical spotting derived by computer is shown for a portion of the 230-kv transmission line between Prescott and Flagstaff, Ariz. The savings result from fewer and/or shorter towers for a given distance. At one or two points in each span the ground clearance is exactly that specified.

The program was initially intended to deal with steel towers for transmission lines to be built by Arizona Public Service. There was no requirement for extension of its use to wooden structures or various voltage requirements. There was also a need to tie the program to an aerial survey method for greater speed in preparing estimates and ordering materials. Success of the initial program led to the decision to add versatility to permit its general use for almost any transmission line. Since completion of the program several means of improvement have come to light. These may be incorporated later.

The benefits to management from such a program, coupled with aerial survey, are manifest. Right-of-way requirements need not be disclosed until the most economical route has been selected.



CLEARANCES and heights were established by simulating parabolic curve for catenary by formula on a computer



TOWERS were fewer or shorter, or both, in given distance, as result of digital computer processing, as described

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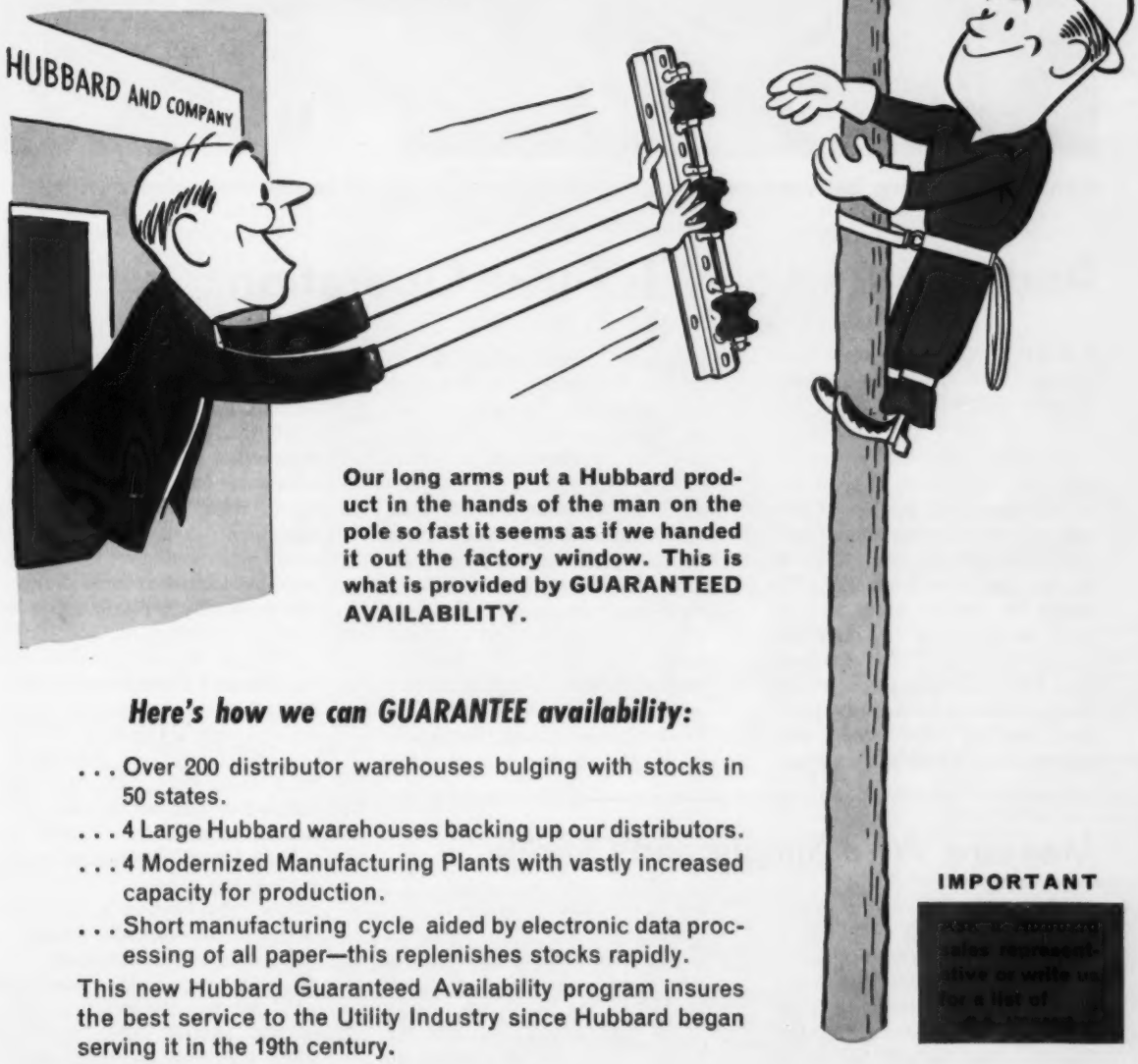

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Portable Radio Aids Plant Operation

P. T. HUTCHISON, Power Plant Manager, Vermilion Station, Illinois Power Co, Decatur, Illinois

Portable radio has proven itself in several phases of operation at the Vermilion Station of Illinois Power Co. Signalling during switch-engine operations in the yard and communications between the control room and remote points about the plant are examples of jobs for which two-way radio equipment is particularly valuable. Two-way portable radios, compared with conventional portable telephones, reduce the time required to establish temporary communication, eliminate hazards created by temporary conductors, make possible communication with mobile equipment, and simplify communication to remote areas.

During coal handling operations in warm dry weather when the atmosphere is clear, hand signalling between the switchman and the diesel-electric locomotive operator is satisfactory. However, when the station area is blanketed with fog, the switchman finds hand signals useless. Previously in foggy weather, either additional men had to be assigned to signalling or the switchman had to walk through the fog until he established visual contact with the locomotive operator. Both methods were hazardous and inefficient. With the two-way radio equipment, contact between the switchman and the locomotive operator can be made quickly and efficiently for safe and economical switch-yard operations.

Portable two-way radios also are effective for communications between points in the main building and remotely located auxiliary equipment, despite the plant's steel framework. The two-way radios are used between the centralized control room and remotely located equipment while performing jobs of a periodic nature, the frequency of which will not economically justify a permanent communication system. For example, the instrument mechanic uses the radio to report to the control room operator when checking the level at the cooling tower. Radios also are used when balancing induced draft fans, testing equipment and for communicating with work crews assigned to jobs in remote areas.

Measure Wire Simply and Quickly

Dispensing wire in the proper quantities has been simplified in the Oklahoma Gas & Electric Co storeroom by a measuring device which has a dial that indicates the number of feet passing through the device as the wire leaves the reel. Reels from which wire is frequently withdrawn are stored on a rack near the measuring device. They are lifted from the rack with the electric fork lift truck, and placed on the measuring device, known as the Reel-o-matic.

The wire end is secured to an empty reel. As the empty reel is turned by a ¾-hp, 480-v motor, the device indicates the amount that has been taken off the other reel. The empty reel is supported so that is can be turned easily. Reels weighing up to 2,000 lb and in sizes up to 36 in. can be handled on the Reel-o-matic.

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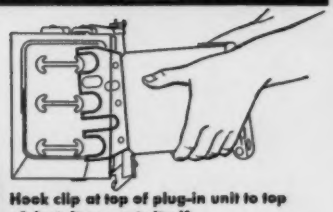
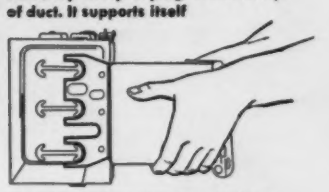


Hook clip at top of plug-in unit to top of duct. It supports itself



Then, just swing plug-in unit down until jaws engage bus bars

Hanger mounting (*not shown*) makes installation easy. A universal hanger permits mounting in *any* position. Just suspend and level top portion of hanger, then clip on lower portion. U.L. approved for 10-foot spacing.

I-beam construction of bus bars—a Square D exclusive—provides four times the strength of conventional bus bars. Bars are zinc, copper and silver-plated full length.

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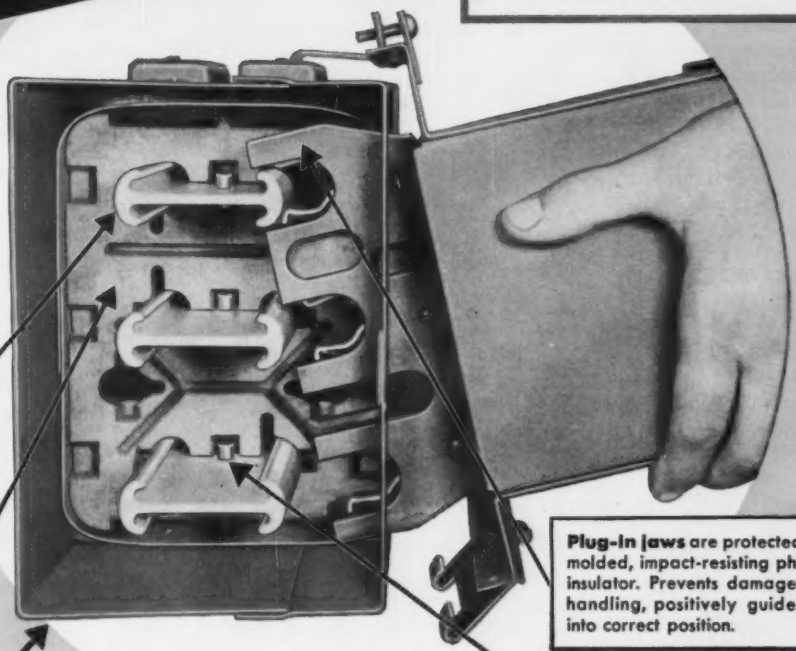
Square D duct is totally enclosed for maximum safety—no danger of accidental shorts. Prevents overheating from dust accumulation.



Plug-in jaws are protected by a molded, impact-resisting phenolic insulator. Prevents damage from handling, positively guides unit into correct position.

Steel pins in each bus bar prevent bars from shifting and support them on vertical riser installations.

With other plug-in duct, it's no easy job to mount the plug-in units. In fact, it takes a lot of real pushing which is neither safe nor easy when you're working on a ladder. With Square D's exclusive *hook-swing* mounting, you just hook the plug-in unit to the top of the duct. Then, simply swing it down and in until the jaws have engaged the bus bars. No awkward pushing required—no unnecessary chances to take. Compare Square D's rugged, heavy-duty construction with any other. It costs no more—why settle for less?

Write for Bulletin SD-110. It gives the facts on Square D aluminum plug-in duct. Address Square D Company, Mercer Road, Lexington, Kentucky

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System components and the variables that affect their cost are shown in an accompanying table. Although this list is necessarily simplified, said Reps, its concise nature presents the key problem areas that are important in attempting to evaluate several distribution expansion policies.

A series of general programs for the IBM 704 computer should lead to improvement in the design of distribution systems. This series, said H. E. Campbell, General Electric Co, will consist of small compatible programs which will eliminate the need to resort to simplifying assumptions as in manual solution of these problems.

First program of the series will calculate sequence impedance of primary line sections from circuit characteristics. This general program is designed for use by all utilities. The second program series will calculate maximum and minimum values of fault currents at all nodes on a radial primary system, using the output from the impedance program as part of its input.

The third program, said Campbell, will make calculations of overcurrent protection for radial distribution systems. Input will include the output of the fault current program, locations of reclosers and fuses, maximum load currents at points of protection, and coordination tables.

Engineering work on a digital computer may be difficult to justify initially, said E. E. Thompson, Arkansas Power & Light Co. Trained programming personnel and input data for distribution problems, for example, must be readily available before economic advantages can be realized fully. However, once the groundwork is laid, he pointed out, computers for distribution engineering will not only be economical but also will provide answers in less time and with a higher degree of accuracy.

Georgia Power Co, with 3.3 million kva of transformers in the 112 substations supplied by its 110-kv system, plans to supplement its single 8,500-kva mobile unit with two more, one of which will be about 25,000 kva, reported Joel Daniel. This expansion of mobile equipment has been brought about by continuing installation of large 3-phase transformers. Currently these units are 25/33 Mva OA/FA for 110-to-66-kv stations; 41.6 Mva FOA for 110-to-44 or 20-kv installations; and 7.5/9.3 Mva OA/FA for most 13-kv distribution units.

Loading is permitted up to the fan-cooled rating of each unit, Daniel continued, with spare capacity only at stations having weak or non-existent subtransmission ties. When load exceeds these ratings, the larger customer connections on distribution circuits are analyzed to determine whether they can be transferred economically to substations tapped to the 110-kv system. Such measures are essential to prolonging the 44-kv system's useful life, he said.

Important Factors Affecting Distribution System Cost

System Component	Key Variables Influencing Cost
Secondaries	Peak Kva Diversified Demand Per Customer
Transformers	Primary-Feeder Voltage
Primary Feeders	Load Density
	Saturation Factor*
	Primary Feeder Voltage
Substations	Primary Feeder Voltage
	Primary Feeder Loading
	Void Factor**
	Subtransmission Voltage
Subtransmission	Subtransmission Voltage
	Distribution Substation Load Capability
	Spacing Between Distribution Substations

* Saturation factor may be taken as the percent of the total area served by a primary feeder representing lots that are occupied by homes.
** Void factor may be taken as the fraction of total area, served from a distribution substation, that is covered electrically by primary circuits.

Microwave Protects 230-Kv

Microwave has been adopted for remote tripping of three-terminal sections of Potomac Electric Power Co's growing 230-kv system within the six cycles needed for stability, said E. F. Mitchell in a paper coauthored by W. W. Valentine. Microwave provides complete freedom from interference and ample channels for relaying, supervisory control, telemetering, and telephone service, he said.

Reliability thus becomes paramount in this microwave system, Mitchell continued. It has been achieved by providing a high "fade" margin, stable antennas and supporting structures, duplicate transmitting and receiving equipment with automatic throwover and continuous monitoring, and power supplies backed by automatic propane-gas-engine generators.

Automatic data logging aids the operation of McMeekin Station which, at 9,093 Btu/kwhr for its two 137.5-Mw units, set a new efficiency record last year, reported O. W. Dixon Jr, South Carolina Electric & Gas Co. The installation logs and records 92 inputs, such as steam and gas flows, coal weight, kw output, pressures, and temperatures, at hourly intervals initiated by a digital clock. Additional logging cycles can be initiated manually, as can readings of any selected points for display at the control console and in the equipment cubicle. The reliability of the system has encouraged SCE&GCo to include a logger-computer in plans for its next power station to read and analyze each unit's operation, alarm off-normal readings, direct and check starts and shutdowns, and calculate the performance of nine remote units, he said.

Most of the functions of on-line computers replace those performed by recorders, operators, clip boards, and office personnel, said L. F. Ken-

(*Continued on page* 138)

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The new *Wire and Cable Casebook* will keep you up to date on the use of neoprene in switches, connectors, accessories and the many other important new products being developed for today's rapidly growing electrical industry.

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Du Pont will send you the *Wire and Cable Casebook* free, four times a year. Take advantage of this new way to keep informed about neoprene, HYPALON® and the newer Du Pont elastomers. Fill out the coupon and mail it . . . *today*. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department, Wilmington 98, Del.

PLACE YOUR SUBSCRIPTION NOW

EW-5

Elastomer Chemicals Department
E. I. du Pont de Nemours & Co. (Inc.)
Wilmington 98, Delaware

Please enter my name for a free subscription to the new quarterly, Wire and Cable Casebook.

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NEOPRENE
SYNTHETIC RUBBER

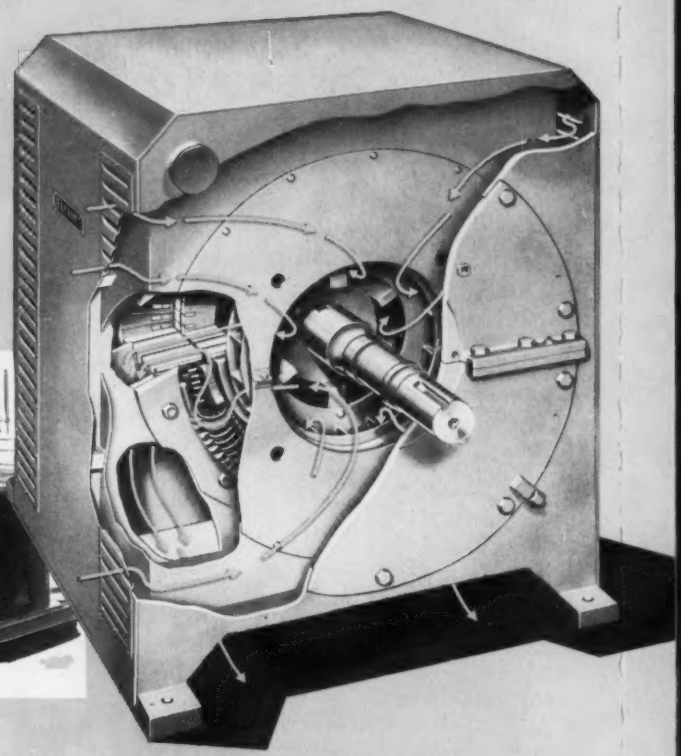
DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry

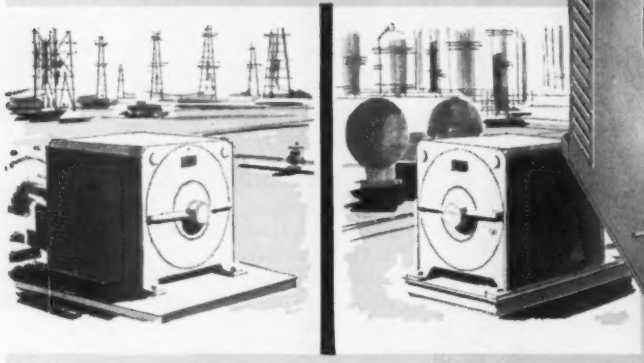
What's this ABOUT PUTTING

You can rely on Elliott Application Engineering....

Open Dripproof designs



Typical applications include outdoor installations (up to 5,000 volts) in petroleum, chemical, steel, mining, paper and many other industries.



AMPLE PROTECTION

for many applications and operating conditions due to the record-breaking performance of Fabri-Seal insulation

Today's large Elliott squirrel-cage induction motors with the now famous FABRI-SEAL coil insulation give you the most complete winding protection available. No other insulation system has such a long record of *proven* field service. Installed in over 2,000,000 hp of motors since 1948, FABRI-SEAL has chalked-up an *unmatched* 10-year operating record.

Note the excellent protection provided by the Elliott dripproof motor enclosure. Skillful arrangement of louvers and baffles prevents incoming air from impinging directly on the motor windings. The changes of direction imposed on the entering air help throw off entrapped moisture and dirt, protecting vital internal parts. This standard enclosure is not only dripproof, but offers splashproof protection equal to that of many splashproof enclosures.

ALL LARGE ELLIOTT INDUCTION MOTORS RECOMMENDED FOR OUTDOOR SERVICE FEATURE:

- protection of all metal parts from corrosion
- space heaters to prevent condensation during shutdown
- screens on air inlets to protect against debris

"INDOOR" MOTORS OUTDOORS?

Elliott engineers will carefully analyze your operating conditions and advise you frankly what type of motor enclosure will give your motors the protection you need... at lowest over-all cost.

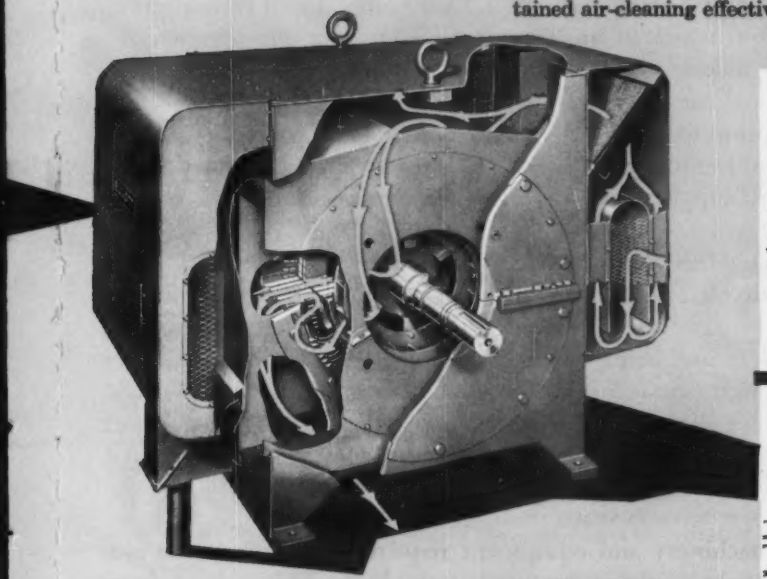
or Weather-Protected enclosures

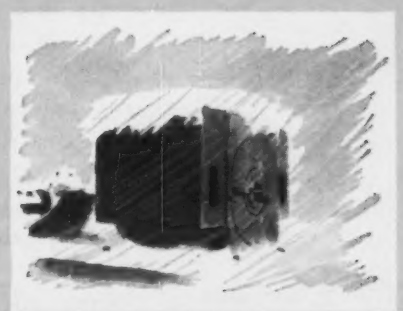
ULTIMATE PROTECTION

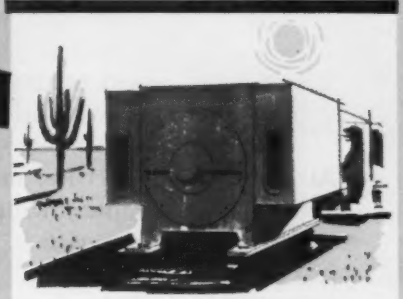
and assured continuity of service in the most severe conditions—driving rains, blizzards, hurricanes, salt spray, dust storms

Years ago, Elliott engineers foresaw the need for fully weather-protected outdoor motors for applications where wind and rain achieved hurricane proportions or where chemical fumes, salt spray, and extreme moistures prevailed. Such a motor would provide optimum reliability, insure continuity of service, and eliminate costly housing. Elliott subsequently designed and built such a motor—the first *really* "weather-protected" motor, with FABRI-STEEL construction and FABRI-SEAL coil insulation. Since 1948, more than 800,000 hp of these weather-protected motors have been installed and have achieved an unmatched 10-year field service record.

The cutaway illustrates how screened horizontal air inlets permit through passage of wind-driven rain, snow or sand; multiple baffles impose numerous direction and velocity changes on the entering air, assuring efficient removal of air-borne moisture; and (when desirable) large, cleanable air filters for maximum sustained air-cleaning effectiveness.







Typical applications include utilities, pipelines, refineries, chemical plants, and other outdoor installations involving severe weather or atmospheric conditions.

ELLIOTT Company
Ridgway Plant, Ridgway, Pa.

PRICING POLICY

New pricing policy is gaining attention, but reaction thus far is varied and vague. General Electric Co's medium power transformer dept stated the policy to utility purchasing men earlier in the year. Briefly, it is that book price will be changed as the market price changes, with no more than a 5% differential existing between the two. One utility purchasing agent reported that this policy is also being followed by GE's capacitor dept, but GE would not confirm this.

Other manufacturers declined to comment on the possibility of adopting a similar policy for some of their product lines. However, several said the new policy was under study.

As noted last week, utility PA's had varied comments. One PA said they could "burn the book" for all he cared, while another said he had "never seen a book." But other purchasing men were more sympathetic. One said that such a policy "would certainly be more realistic. If they do it, I think it would be a good thing and might help stabilize the market." Another said, "It's certainly a trend in the right direction and might help build up some confidence in prices."

COAL ▶ **Tennessee Valley Authority estimates it will burn 300 million** tons of coal during the next 10 years—about three times the amount burned in the past decade. By 1970 TVA's annual coal consumption will be an estimated 40 million tons—about twice the present rate of use. For several years TVA coal use has comprised about 11% of the national use for power generation. In recent weeks TVA has taken an option to purchase some 60,000 acres of coal land in four southeastern Kentucky counties. This is another effort to assure adequate coal supplies for generation in the eastern part of its system.

BIDS ▶ **When five bidders submitted identical quotes** for mill steel products, TVA divided the $1.25 million order equally among the five.

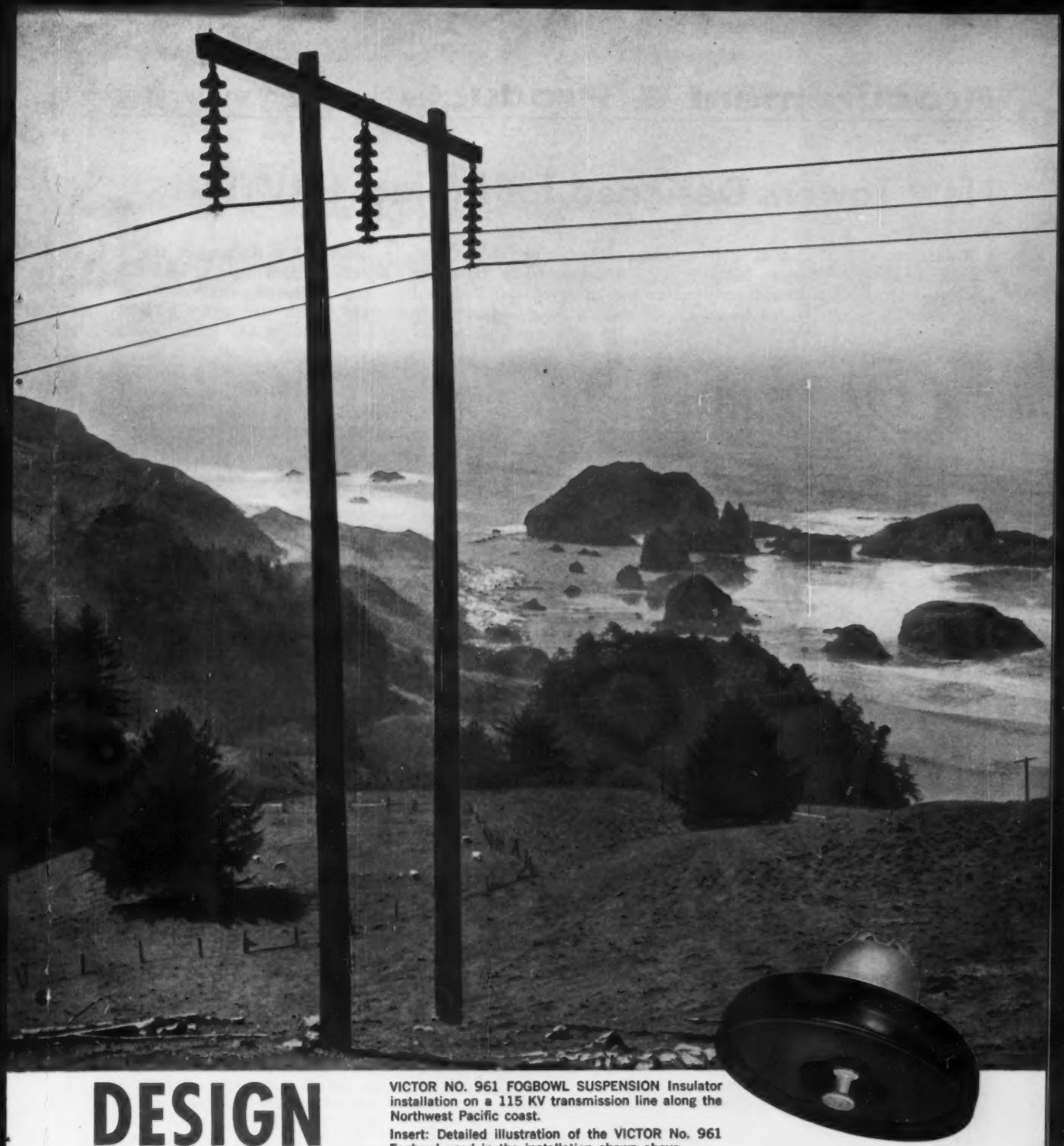
COPPER

Copper prices are being sustained because of the Chilean mines strike and high demand in Europe, according to industry sources. There is some disagreement in the industry as to how long prices will hold. At least two large domestic producers foresee demand holding up well into the later months of the year.

ALUMINUM ▶ **Electrical machinery and equipment requires 9.2%** of all the aluminum wrought products produced in the U. S. This is down from about 10.3% required during the first six months of 1958.

ATTENTION

Other items in this issue of interest to purchasing men are: stories on purchasing practices and disposal of surplus material beginning on page 119; report on Edison Electric Institute Purchasing & Stores meeting, page 64.



DESIGN

VICTOR NO. 961 FOGBOWL SUSPENSION Insulator installation on a 115 KV transmission line along the Northwest Pacific coast.

Insert: Detailed illustration of the VICTOR No. 961 Fogbowl used in the installation shown above.

VICTOR has done more constructive research on insulators for contaminated areas than any other manufacturer in the field. Dramatic proof is the creation of the already famous No. 961 Suspension shown above.

Here is an entirely new concept in fogbowl insulator design . . . a totally different but effective answer to the problem of insulating in areas suffering from the contaminating effects of salt-laden air, fog, smog, dust, chemical or industrial fumes.

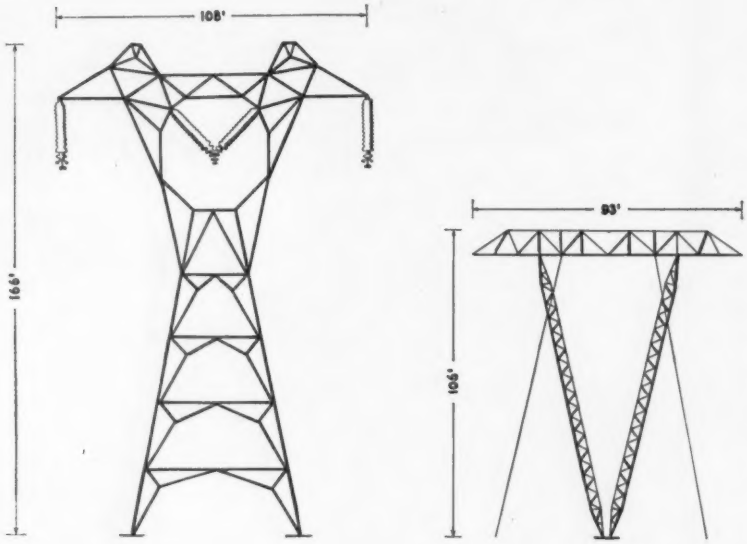
VICTOR No. 961 fogbowl suspensions were selected for this installation after exhaustive field tests conducted over a period of years on many makes of both conventional and fogtype insulators. The customer reports perfect service after years on the line . . . **with no expensive insulator washing.** Look to VICTOR when you have a contamination problem. For catalog, specifications and prices, contact your nearby VICTOR Sales Office. Victor Insulators Division, I-T-E Circuit Breaker Company, Victor, N. Y.

I-T-E CIRCUIT BREAKER COMPANY

New Towers Designed for Project EHV

Aluminium Ltd of Canada and Commonwealth Associates have completed designs of aluminum and steel towers, respectively, for General Electric's Project EHV, near Pittsfield, Mass. Alcan, a new co-operator, brings number of companies associated with GE in the research project to twelve.

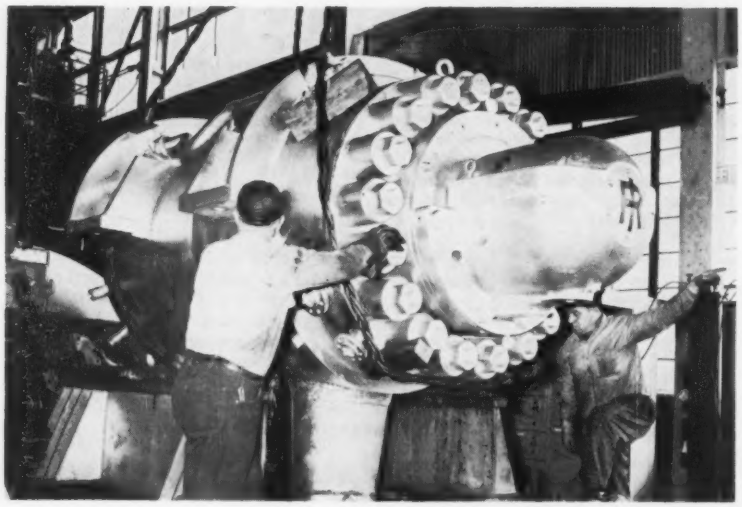
The Alcan 4,500-lb aluminum tower will be guyed and V-shaped (right, below). Masts will be 101 ft long, the cross arms located 98 ft above ground will be 93 ft long. Michael Flynn Mfg Co, Philadelphia, Pa, will fabricate this tower, No. 8 in the project, reports Alcan's H. B. White.



One of the two steel towers designed by his company, says J. A. Foote, of Commonwealth Associates, will be one of two highest structures in Project EHV: 166 ft tall and will have a narrow base to reduce weight (illus. left). It will be used for a 2,200-ft span across the Housatonic River. The other tower will have a more representative height of 123 ft, will also have a narrow base. American Bridge Div of United States Steel will make both towers.

GE's Dr Pier A. Abetti, project manager, indicated rapid progress is being made on the EHV experimental system, with all of the 115-kv apparatus and much of the 650-kv equipment in place in the north station. The station is scheduled for energization for preliminary, 115-kv corona testing by June. By September the 0.6-mile northern section should be complete and energized at 460 to 500 kv. Next year the southern section and substation will be finished and the voltage raised to 650 kv.

Ingersoll-Rand Builds 22,000-Bhp Pump for Sporn's No. 5



When the Ohio Power Co's 450-Mw generating unit at Philip Sporn plant goes into service late in 1960, Unit No. 5 will be served by the world's largest boiler-feed pump in terms of horsepower and capacity (left).

The 22,000 bhp pump, weighing 42 tons, is designed to handle approximately 7,200 gpm at a discharge pressure above 4,500 psig. It is the second of two identical units built by Ingersoll-Rand for American Electric Power System.

When this photograph was taken, the pump was ready for I-R's shipping department after successfully undergoing a rigorous performance

(*Continued on page 99*)

¾ HOOK . . . preferred by linemen, makes it easier to engage the eye of the clamp to be removed. Extra-strong bronze ¾ hook seats deep in head casting to prevent twisting open. Note, too, how yellow color assures hi-visibility where it counts most . . . at the "business end" of the stick.

new!

KEARNEY

YELLOW FIBERGLAS CLAMPSTICK

...with enclosed mechanism...added safety features

NEW! **A shotgun stick you can always see... in any light... against any sky... in the beam of a spotlight.**

NEW! **Telltale yellow surface shows instantly if the stick is safety-clean.**

NEW! **Smooth-as-silk operation... fully enclosed operating rod and mechanism... ¾ hook... thumb latch.**

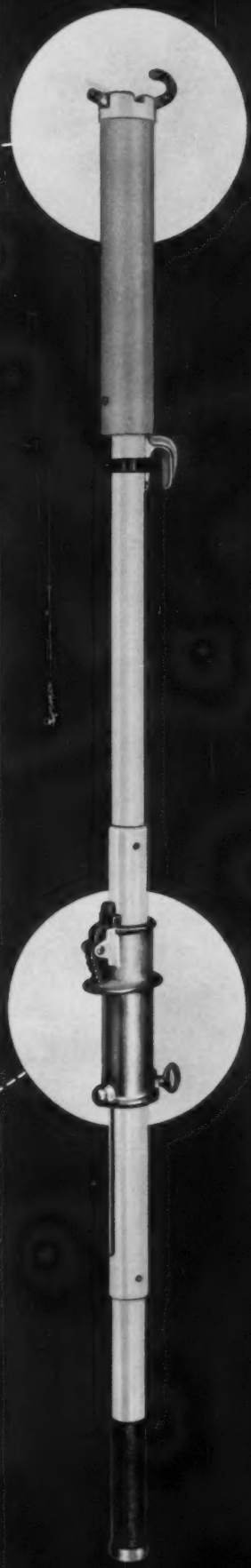
Kearney's new clampstick combines the lightness, ruggedness and high dielectric strength of a Fiberglas pole with a slick new mechanism . . . plus an important bonus . . . yellow color permanently molded-in for maximum visibility. Needs no costly refinishing.

Operating rod mechanism is fully enclosed, protected . . . prevents rod damage, eliminates rod servicing. Only 3 moving parts . . . nothing to bind, stick, get out of adjustment. Field-strips for fast, easy cleaning by removing only *one* screw. Equipped with ¾ hook . . . thumb latch, safety-lock and stop. Non-slip grip.

Yellow non-porous surface instantly shows soil, grease or dirt which might cause excessive leakage . . . wipes "safety-clean" in seconds.

Tested for 100 kv per foot for 5 minutes.
Available in 4′, 6′, 8′, 10′ and 12′ lengths, one-piece or hinged.

501



THUMB LATCH . . . conveniently located on aluminum operating handle. Faster, easier to use with gloves. In latched position keeps hooks open while engaging clamp eye . . . prevents accidental retraction of hook. Sharp downward pull of handle releases latch, closes hook. Safety stop prevents accidental opening of hook while clamp is engaged. A locking wing screw is also provided.

for better construction . . . safer maintenance . . . specify KEARNEY products

JAMES R. KEARNEY CORPORATION
ST. LOUIS, MO.

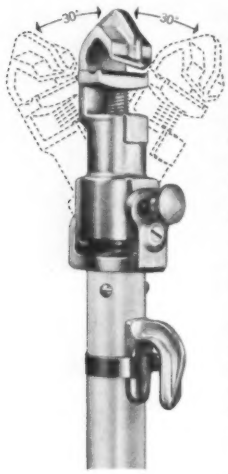
JAMES R. KEARNEY CORPORATION

4224-42 Clayton Avenue, St. Louis 10, Missouri

PLANTS AT: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA

3 Kearney products to make the lineman's job easier...safer!

ADJUSTABLE HEAD JUMPER HOLDING TOOL



Aluminum alloy head is adjustable 30-degrees either side of center . . . rigid in all positions.

Gives positive control . . . tight grip . . . easiest handling of slack conductors. Enables linemen to maintain required safety clearance when working jumpers on difficult angles. Invaluable for accurately positioning jumpers at maximum reach from pole . . . for making hot line splices and taps.

Clamping screw has smooth, no-drag drive. Yellow Fiberglas handle and plastic covered, laminated fir, clamp-screw operating rod provide maximum safety. Light weight, wide range . . . 6 solid to 336.4 MCM ACSR. Pole length 4′ or 6′.

JUMPER CLAMP

Extra-wide range accommodates the large conductors of high capacity distribution systems . . . 1,192.5 MCM ACSR or 1,300 MCM stranded to 6 solid. Jumper cables up to 4/0 15,000 volts fit in the T-bolt terminal . . . without disassembly for installation. The aluminum alloy head will carry 400 amps. Maximum safety is assured by a yellow Fiberglas handle over the plastic covered, laminated fir, clamp-screw operating rod with colored-coded, non-slip gripping area. Light weight . . . only 4 pounds.

COMPRESSION FERRULE ALUMINUM GROUNDING SETS

The only "dead" or de-energized circuit is a *grounded circuit.* Get safe cable connections . . . less weight . . . with this family of grounding clamps for *aluminum* grounding cable. Ferrules are compressed onto the cable with the WH-1 or WH-2 hydraulic tool . . . threaded into the frame . . . locked with a jam nut. Take 600 volt aluminum grounding cable up to 4/0. Single grounding clamps and 2-, 3-, or 4-clamp cluster sets available in two sizes with ranges from 8 solid to 666.6 MCM ACSR or to 2″-diameter. Jaws of flat face clamp open 1.5″.

for better construction . . . safer maintenance . . . specify KEARNEY products

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801

I-R Builds 22,000-Bhp Pump

(*Continued from page* 96)

test program under simulated operating conditions at the company's new hydraulic test facility. S. H. Weaver, chief of I-R's pump engineering section, believes this facility is the largest in the industry in terms of horsepower and capacity. It is equipped with a 22,000-bhp steam turbine and a closed-loop feed water system. Temperature is controlled by drawing off hot water while injecting cold.

The single, full-capacity boiler-feed pump concept designed into Unit No. 5 represents a departure from the design philosophy followed for the Sporn plant's first four units. In the latter units, first of which went on line in 1950, three I-R 2,000 bhp pumps, handling 1,100 gpm at 2,385 psig, serviced each unit. Two pumps teamed to handle full load requirements, while the third served a stand-by function.

In contrast, Unit No. 5 utilizes an I-R 11,000-bhp motor-driven pump rated at 3,600 gpm at 4,550 psig as a start-up pump. The main pump cuts into the line as soon as the main turbine can supply extraction steam to the 22,000-bhp turbine driving the pump.

Weaver, commenting that reliability and continuity of service are important in this single full-capacity pump system design, points out typical design features: heavy-duty, pivoted shoe bearings and floating-ring stuffing boxes engineered into the barrel-type, seven-stage pump.

The 42-ton pump measures more than 14 ft from outboard bearing to the coupling, stands 7 ft high from the bottom of the bed-plate to the top of the barrel. It has a rated suction pressure of 485 psig and operating temperature of 427F.

Technicians for Hire From General Electric

A new service introduced by General Electric makes it possible for any business, institution or individual in the country to hire GE skilled technicians to measure and record virtually any quantity or combination of quantities, using the finest laboratory-type instruments.

(*Continued on page* 102)

Now—A *unitized* power pack for *maintenance free* switchgear tripping and control!

Utilities and industrial plants can greatly increase their margin of reliability and protection for switchgear and control equipment by using C & D's *AutoCal** *unitized* Power-Pack.

Here's a dependable, high-capacity power package specifically built for tripping and control that pairs a simple, compact, C & D *AutoReg*® Silicon charger with powerful, lead-calcium grid control batteries. No adjustment or manual switching is required.

The charger is a completely automatic, constant voltage, current limiting unit. It regulates DC output voltage within ±1% in floating range over an AC input variation of ±10%. The silicon rectifying element has no known aging characteristics. Consequently, there are no aging taps and the attendant adjustment of these is eliminated. *AutoCal* has no moving parts and it utilizes a standard 115 volt, 60-cycle, single phase outlet as a power source.

PlastiCal® batteries** have extra thick positive plates (0.266"). They provide a high one minute rate. Lead calcium grid batteries require 1/5 to 1/10 as much current to maintain a fully charged condition as do conventional batteries. Consequently, there is so little electrolysis of water occurring that the batteries need be watered only once a year.

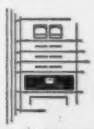
The combination of a C & D *AutoReg* charger and *PlastiCal* battery gives you self-protected charging . . . instantaneous peak power on demand . . . and long trouble free life.

Get the full details—write for Bulletin AR-102 today!

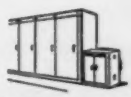
CHOICE OF MOUNTINGS

CUBICLE MOUNTING. Most popular method mounts *AutoCal* on the door of associated breaker cubicle.

WALL MOUNTING. Charger may be wall mounted near bank of indoor switchgear.



RELAY RACK MOUNTING. Charger is available with front panel for standard 19" relay rack.

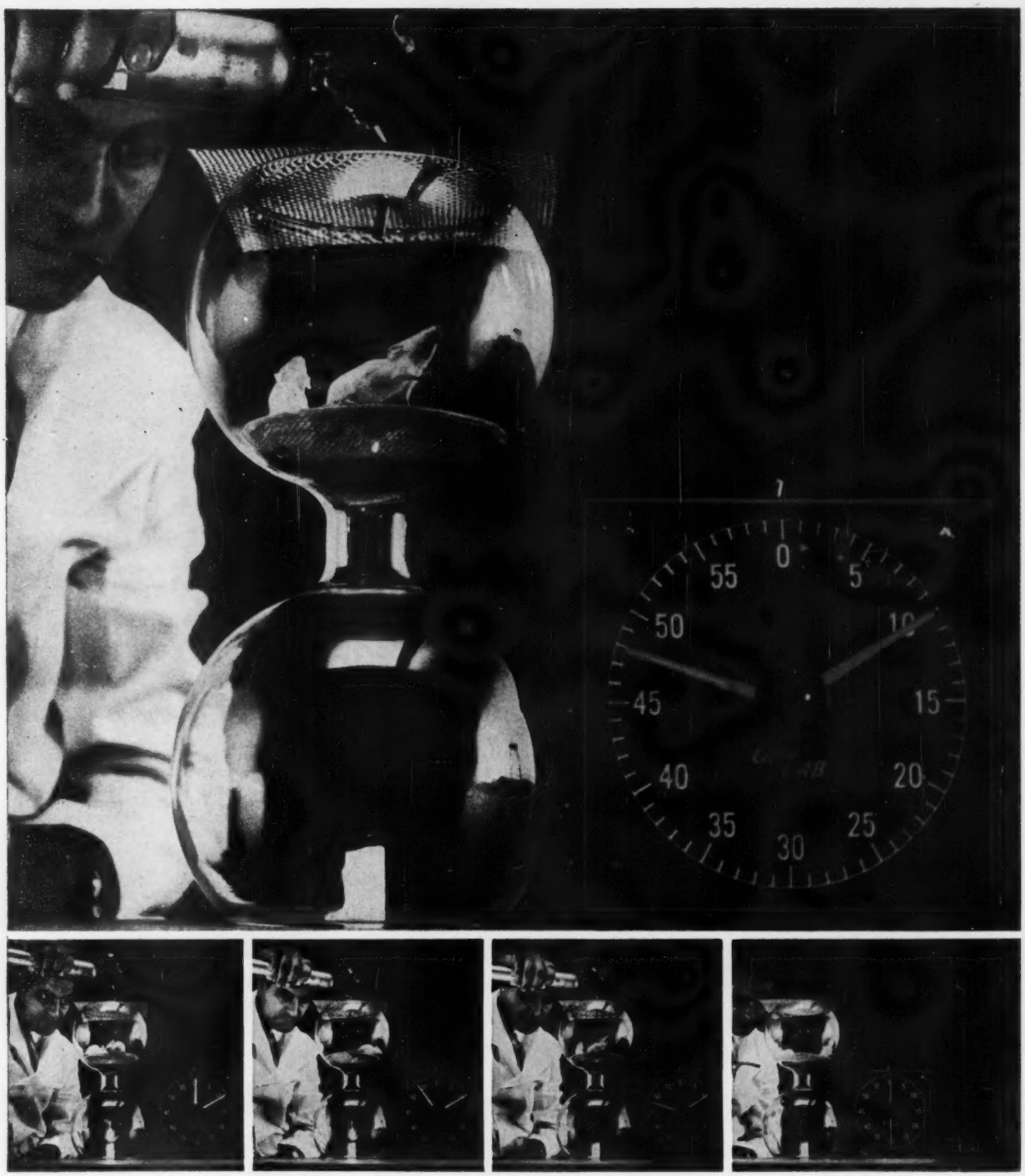


WEATHER-PROOF OUTDOOR MOUNTING. Both charger and batteries fit in a weather-proof cabinet for use with outdoor switchgear.

C&D C & D BATTERIES
of Conshohocken, Pa. . . . Attica, Ind.
DIV. THE ELECTRIC AUTOLITE CO.

Manufacturers of Slyver-Clad® Industrial Batteries • PlastiCell® and PlastiCal® Batteries for Communications, Control, and Auxiliary Power • Producers of AutoReg® Silicon Chargers and AutoCal® Charger-Battery Combinations

**Trademark, C & D Batteries Div. The Electric Autolite Co.*
***Designed for 25 year life*



THIS SIMPLE TEST, USING TWO MICE AND A CANDLE, PROVES SF_6 GAS IS COMPLETELY INERT... NONFLAMMABLE, NONTOXIC, SAFE

In this demonstration, time clock is set for 10 minutes, and SF_6 gas is released into top chamber containing mice. Heavier-than-air SF_6 engulfs animals and sinks to bottom chamber, snuffing out candle. Final frame taken 9½ minutes later shows mice in excellent condition. Laboratory tests have shown animals can live in a mixture of 80% SF_6 gas and 20% oxygen for 24 hours without ill effect. Even after repeated arcing in high-power laboratory tests, SF_6 gas is handled without special precautions.

Inert SF_6 gas boosts breaker safety

Makes possible greatly improved performance from 34.5 kv to 460 kv and beyond

A truly unique quality of SF_6 gas as a circuit breaker arc-quenching medium is its inertness. This quality promises safer power breakers . . . as well as breakers that are easier and less expensive to install, to operate and to maintain. The nontoxic, nonflammable properties of SF_6 gas are demonstrated in the photo at the left. In the future, Westinghouse SF_6 circuit breakers, even at extremely high ratings, will be applied in all substations including urban with perfect safety. Quiet operation is assured by the closed gas system.

In addition, SF_6 is highly stable . . . assuring long life of the gas as both an arc-quenching and an insulating medium, even after repeated interruptions. SF_6 (sulfur hexafluoride) has high dielectric strength, recovers full dielectric properties rapidly . . . assures unexcelled arc extinction time after time. Because of the design flexibility offered by this new medium, Westinghouse is now able to bring you equipment that combines the advantages of both oil and air breakers, as well as further advantages offered by neither.

Westinghouse power circuit breakers using SF_6 gas are basically new breakers. But they have proved themselves at several voltages and also promise the most practical design avenue in capacities of 460 kv and beyond.

Westinghouse suggests you buy two of these new breakers in widely separated ratings and apply them in entirely different operating situations. Prove to yourself that they will give you combined performance and economy you cannot get in any other breaker.

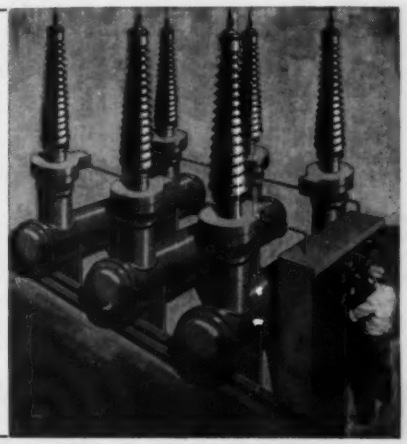
Call your Westinghouse representative today. Or write: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-60982

PROVE THE OUTSTANDING PERFORMANCE OF THIS BREAKER ON YOUR OWN SYSTEM

The principle of circuit breaker design using SF_6 gas has already been proved successful on several operating systems. Breakers from 46 kv to 115 kv have now completed over two years of service.

With SF_6 breakers you get: FAST INTERRUPTION; EASY INSTALLATION; SIMPLE, LIGHT FOUNDATIONS . . . no ground shock during interruption . . . elimination of oil and size reduction cuts weight up to 65% at 230 kv; DRASTICALLY SLASHED MAINTENANCE . . . SF_6 does not decompose . . . interrupter easily removed; COMPLETE SAFETY AT ALL TIMES . . . dead tank construction; QUIET OPERATION . . . no discharge to atmosphere . . . closed system conserves gas.



YOU CAN BE SURE... IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV ALTERNATE FRIDAYS

When transmission towers are rust-protected with Subox paints, both labor and material costs are much lower over the years. A single coat of Subox on weathered galvanizing will generally last for a minimum of 6 to 8 years and many companies report an average life of more than 10 years.

Furthermore, because Subox paints adhere well and weather gracefully without peeling, a good repaint surface is developed and preparation costs for future repaintings are greatly reduced.

Subox paints are the only American-made paints with *suboxide of lead*. This pigment remains chemically active even after drying and forms a fibrous protective film that withstands the most punishing exposures.

Leading electric utility companies from coast to coast depend on Subox paints to protect their transmission towers. Send for color card and literature.

SUBOX PAINTS

Subox Inc.
Trade Mark

Established 1924
Subox Company of Canada, Weston, Ontario
3 Fairmount Plant, Hackensack, N. J.

GE Technicians for Hire

(*Continued from page* 99)

This augments the company's instrument rental program, inaugurated last year.

Like the rental program, the hiring of technicians is administered through GE's network of service shops across the country. The customer pays on a per-diem basis. A staff of technicians is maintained at Schenectady, N. Y., with a variety of instruments, cameras, and recorders. Each piece of equipment is in its specially designed and padded trunk for speedy shipment to and from the job. This service has been available for more than 40 years to company components.

The measurement service employs three general methods: (1) High-speed motion pictures for recording and direct analysis of physical quantities. Speeds up to 7,500 pictures per second permit study of motion slowed to 1,400th of normal. Films in color or black and white can be processed on the spot. (2) Magnetic oscillographs for simultaneously recording a dozen or more different changing quantities over any given period of time. Cathode-ray oscillographs are available for simultaneously recording as many as four channels. (3) Shock-testing of material or products.

Datex Corp Supplies Fermi Logging System

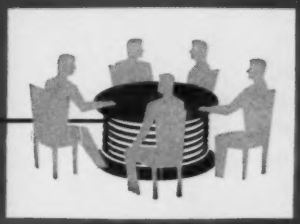
Detroit Edison's Enrico Fermi's atomic reactor will use a logging system designed and built by Datex Corp. The system will provide a record of the reactor's operation, also giving warning if there is any departure from proper following of instructions.

The equipment will play an important role in the operation of the plant's large fuel-handling manipulator. From its location inside the reactor vessel, the manipulator is controlled electronically from a panel in a separate control building.

An offset handling crane and rotating plug work together to assemble the reactor fuel and blanket material. The logging system provides an automatic typewritten record of the operations performed by the offset crane and plugs in the sequence of these operations.

DU PONT

WIRE AND CABLE ROUND TABLE

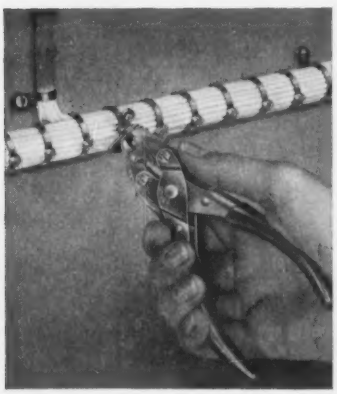


New "Ty-Raps" of ZYTEL® are light, strong, easy to use

New "Ty-Rap" cable ties and straps of Du Pont ZYTEL® nylon resin provide an easy, economical and effective method of securing wire.

Both the ties and straps are quickly and easily installed, greatly reducing labor time and costs. The "Ty-Raps" can accommodate any size wire bundle from 1/16" to 1¾" diameter, eliminating the need for a variety of sizes. Weighing just a fraction of an ounce, the ties and straps will take forces greater than 60 pounds without breaking their grip. All "Ty-Rap" devices are easily molded to exact specifications, and will perform dependably over a wide range of temperatures.

The "Ty-Rap" cable ties and straps, molded of Du Pont ZYTEL, are products of The Thomas & Betts Co., Inc., Elizabeth, N. J.



Du Pont does not manufacture wire and cable, but supplies thermoplastic resins to the wire and cable industry.

Workers inspect the pulling of both power and control cables protected with ALATHON® and ZYTEL® through an extensive tray distribution network.

Combination of Du Pont plastics and tray distribution system saves over $300,000 in plant installation costs

Taking advantage of the unique combination of properties offered by the use of Du Pont ALATHON polyethylene resins and ZYTEL nylon resins, electrical engineers recently "powered up" an entire chemical processing plant through the use of economical tray distribution system networks. As a result, $303,600 in installation costs were saved over the expected cost of the standard conduit system.

This saving was made possible for several reasons. Because of the excellent electrical insulating properties of ALATHON, the finished cable was smaller than normally required for the same rated capacity. This meant smaller, lighter easier-to-install cables, and therefore more cables in the same trays. The extremely low coefficient of friction and high abrasion resistance of the armor of ZYTEL allowed the cables to withstand the abuses of pulling miles of cables through serpentine tray networks.

While the decreased installation costs were a big factor, the reliability of the cable was not sacrificed. Since this was a highly automated plant, any possibility of cable failures had to be virtually eliminated. That's why careful attention was paid to the proper selection of materials, and that's why ALATHON and ZYTEL were specified.

Through control of molecular structure, Du Pont has developed special grades of polyethylene that combine the excellent electrical properties inherent in all polyethylene with other desirable properties, such as corona resistance and environmental stress-crack resistance. There is an ALATHON or ZYTEL resin tailored to fit almost any electrical need.

Substantial installation savings such as these are not unusual with cable insulated and jacketed with Du Pont plastics. Consult your wire and cable manufacturer, or write E. I. du Pont de Nemours & Co. (Inc.), Department M-5, Room 2507A, Nemours Bldg., Wilmington 98, Delaware. In Canada: Du Pont of Canada Limited, P.O. Box 660, Montreal, Quebec.

POLYCHEMICALS DEPARTMENT

DU PONT
REG. U.S. PAT. OFF.

ALATHON® POLYETHYLENE RESINS | **RULAN®** FLAME-RETARDANT PLASTICS | **ZYTEL®** NYLON RESINS

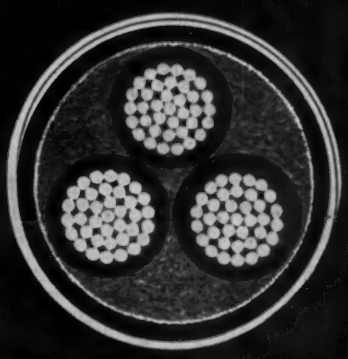
BETTER THINGS FOR BETTER LIVING...*THROUGH CHEMISTRY*

SPACE SAVING
EASILY TRAINED
LIGHTWEIGHT LONG
RUNS LOW INSTALLED
COST FLEXIBILITY FOR
FUTURE CHANGE AND
EXPANSION

GENERAL CABLE

INTERLOCKED ARMORED CABLE

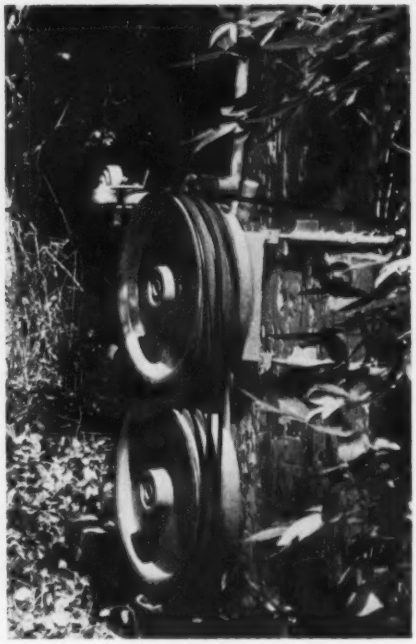
For full protection under all conditions install General Cable Interlocked Armor...the cable for power, control, communication and lighting systems. This compact, versatile cable is available in a wide range of constructions, insulations, armors and voltage ratings. Colored polyvinyl chloride jacket over the armor can be furnished where required. "How to Obtain the Greatest Advantage Per $ Spent" a comprehensive folder detailing General Cable's complete line of Interlocked Armored Cables is available upon request. **General Cable Corporation**, 730 Third Avenue, New York 17, New York. Offices and Distributing Centers Coast-to-Coast.



(For further information refer to Readers Service on page 114)

Computer System . . .

. . . for small companies introduces a new input method: four strips of magnetic coating on backs of otherwise conventional, legible ledger cards enable these cards to be input to the computer. The NCR 390 also takes punched card or tape or keyboard input. The system is complete for calculating and processing data. The magnetic ledger card can also be used for recording output.
National Cash Register Co, Dayton 9, Ohio.



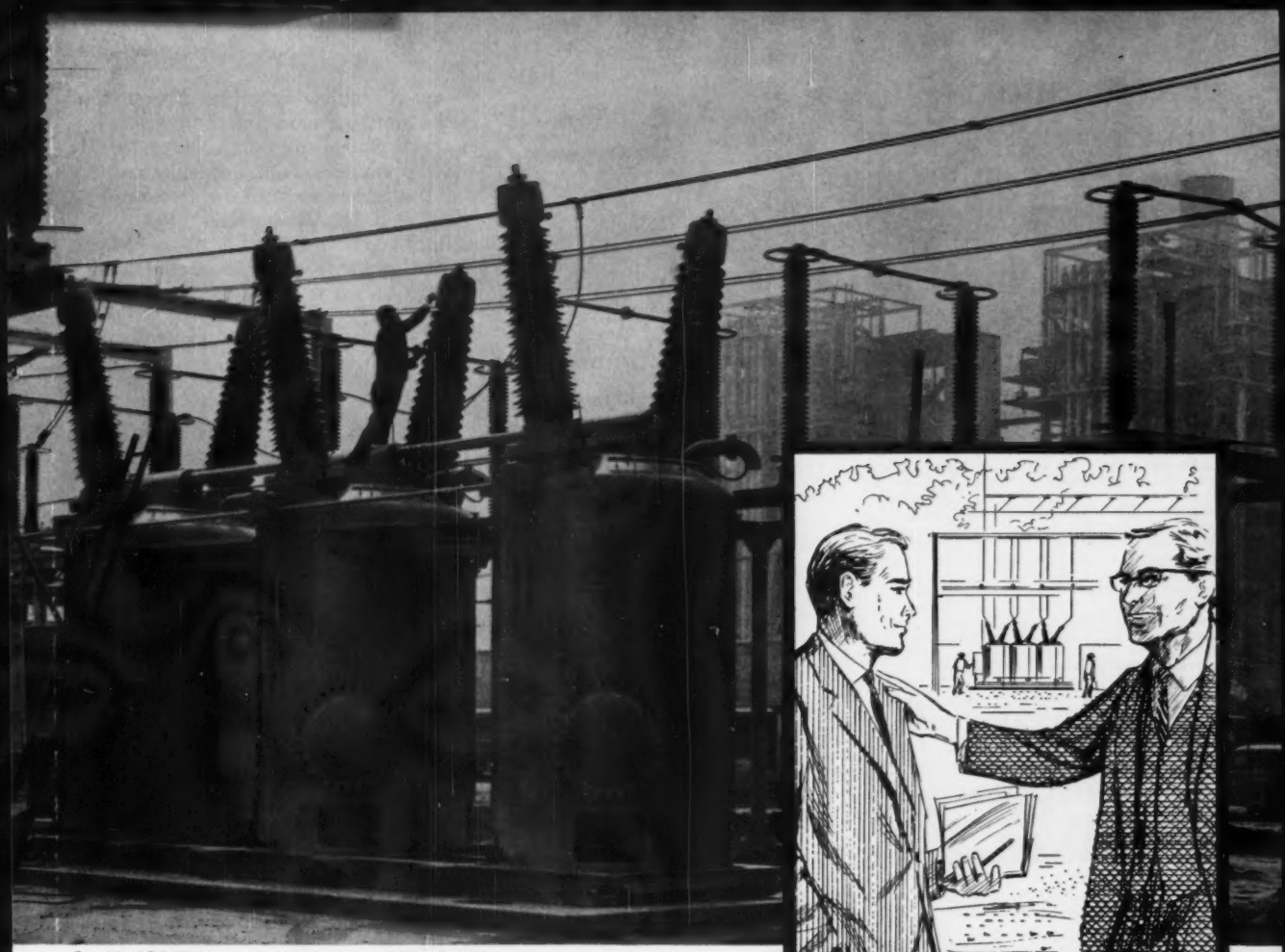
Pole-Mount Tensioner . . .

. . . now pulls 1,000 lb tension and handles conductors to 397.5 MCM AAC capacity. The improved Pengo 4000 PM has multigroove neoprene-lined double bullwheels and some parts are of magnesium to save weight. It can be carried by two men. The input fair-lead swings to either side so that pull can be from either side, even if the pole is next to a wall.
Petersen Engineering Co, Santa Clara, Calif.

Interrupter Switch . . .

. . . is opened and closed by stored energy of a spring, hence operating speeds are independent of the operator. Type LVP-21 switch is manually operated by rotating a front handle. Closing rating is 40,000 amp assymmetrical, load and load-break rating 600 amp. Ratings furnished are 4.7 kv with 60-kv BIL and 13.8 kv with 95-kv BIL. It is designed for low voltage load centers. A special handle and clip allow slow make operation for maintenance and adjustment.
General Electric Co, Schenectady 5, N. Y.

(*More New Equipment on page* 108)



One of four I-T-E, 230 KV power circuit breakers being installed at Southern California Edison Company's new 820-Mw steam station, Huntington Beach.

Doing business for more than 50 years—Southern California Edison Company and I-T-E's Kelman Division:

- **the first 30 KV oil breaker in 1906**
- **the first 230 KV oil breaker in 1937**
- **1000's of breakers between '06 and '60**

ANOTHER JOB WELL DONE...

by the Kelman Power Circuit Breaker Division of I-T-E

When the Southern California Edison Company of Los Angeles decided to boost the output of its new Huntington Beach steam station by adding two computer-supervised turbine-generator units, they selected each of their equipment suppliers with the utmost of care. The successful bidder for four, new, 230 KV power circuit breakers was the Kelman Power Circuit Breaker Division of I-T-E—people with whom this utility has been doing business for more than 50 years.

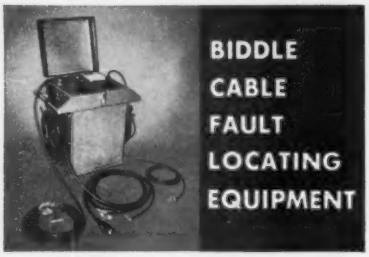
Back in 1906 the Kelman Electric & Manufacturing Company supplied the then Edison Electric Company with a 30 KV oil breaker. Since that time thousands of Kelman breakers have been put into service as the Southern California Edison Company has expanded its facilities to match the growth of the great California Southland.

Through the years, there has remained the same fine relationship that started fifty-four years ago. It is a business relationship that has been maintained by Southern California Edison Company's insistence on a quality product and I-T-E's determination to continue to supply that kind of product at a competitive price.

For descriptive literature on I-T-E's field-proven power circuit breakers, write to 1667 North Main Street, Los Angeles 12, Calif., Dept. EWO-962-1.

I-T-E CIRCUIT BREAKER COMPANY
KELMAN POWER CIRCUIT BREAKER DIVISION

...For Locating Faults in Lead-Covered Cable ...For D-C Proof Testing

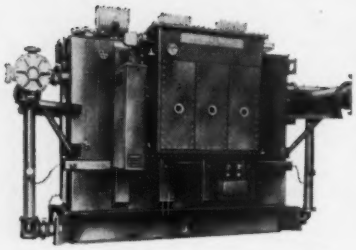


Has applications on aerial, or buried cable, as well as on lead-covered cable installed in ducts. Equipment combines a high-voltage capacitor discharge transmitter with a detector to form a complete Tracer Current Set. Provides high current and voltage output with small energy input. Equipment is moderate in size, weight and cost. Use is not restricted by networks or branches, and under certain conditions will even operate successfully without disconnecting transformers. Method of detection indicates whether fault has been reached or passed when an exploring pick-up coil is applied at various points along the cable.

Biddle Models	Output Voltage	Discharge Capacitance
Catalog 651125	Up to 25 KV	1.65 muf
Catalog 651015	Up to 15 KV	2 muf
Catalog 651005	Up to 5 KV	16 muf

B-1005 **Write for Bulletin 65-W**

JAMES G. BIDDLE CO.
Electrical and Speed Measuring Equipment
1316 Arch Street, Philadelphia 7, Pa.

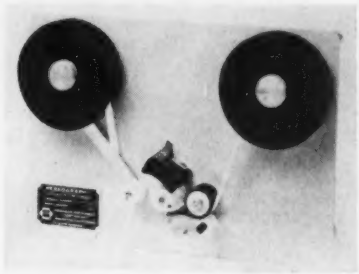


Furnace Transformers . . .

. . . have heat exchangers and bus-bar seals added. FOW heat exchanger is for use only with pumps; OW/FOW operates with natural or pumped flow. Pressure seal for the low-voltage bus bar assembly withstands full vacuum and positive pressure to 10 psig.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Rectifier Stacks . . .

. . . are rated from 2 to 105 amp, with peak inverse voltage ratings from 50 to 600 v. Pre-assembled silicon rectifier stacks have copper fins for high heat dissipation, with nickel plating and epoxy coating for corrosion resistance. Available sizes are 2x2, 3x3 and 5x5 in. Resistors for voltage dividing can also be furnished.
Vickers Inc, Electric Products Div, 1815 Locust St, St. Louis 3, Mo.



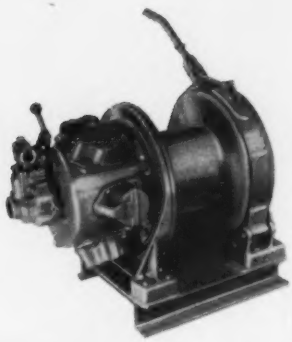
Data Recorder . . .

. . . is portable and consumes little power. It records in a visually readable and machine sensible form. The Perfograph digital data recorder stores information as electronically

KYOVA

Jet age

made perforations on narrow paper tape. Transducers for such inputs as temperature, pressure, numerical count are available.
Advanced Instrument Corp, 700 S 4th St, Richmond, Calif.



Air-Powered Hoist . . .

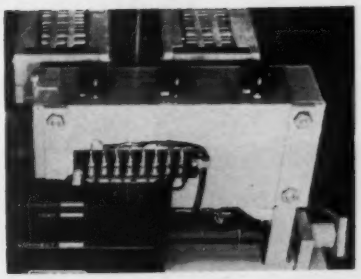
. . . raises 7000 lb at an average lift speed of 65 fpm. K6U's 6-cylinder reversible air motor has continuous speed control and a self-energizing brake. It has a single drum and operates without multiple reeving. Smaller K6UA is rated at 5,000 lb and 95 fpm. Remote controls are also available.
Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y.

Chloride Ion Analyzer . . .

. . . monitors boiler water continuously and automatically. Three models have ranges of 0.1-10 ppm, 1-1,000 ppm and 10-10,000 ppm. They are read directly from a meter or from a potentiometric recorder. Accuracy is within 5% in most applications. The analyzer has but two simple controls.
Beckman Scientific and Process Instruments, Fullerton, Calif.

Overcurrent Trip Device . . .

. . . has no moving parts. Tripping transformers mounted on type LA low-voltage circuit breakers, for which this static device was designed, supply tripping power. Minimum pickup can be set between 80% and 200% of rated breaker current. Instantaneous pickup is adjustable between 4 and 30 times minimum pickup setting.
Allis-Chalmers Mfg Co, Milwaukee 1, Wis.



Photoelectric Control . . .

. . . for lighting has injection-molded plastic cover and base, which provide high dielectric strength. Twist-lock base fits standard receptacles. Lamplighter series

(*Continued on page* 112)

Chicago O'Hare Field
Mayor: Richard J. Daley
Commissioner of Public Works: George L. DeMent
Commissioner of Aviation: William E. Downes, Jr.
Architects and Engineers: Naess and Murphy,
Electrical Contractors: Main Electric Co.

fiber conduit

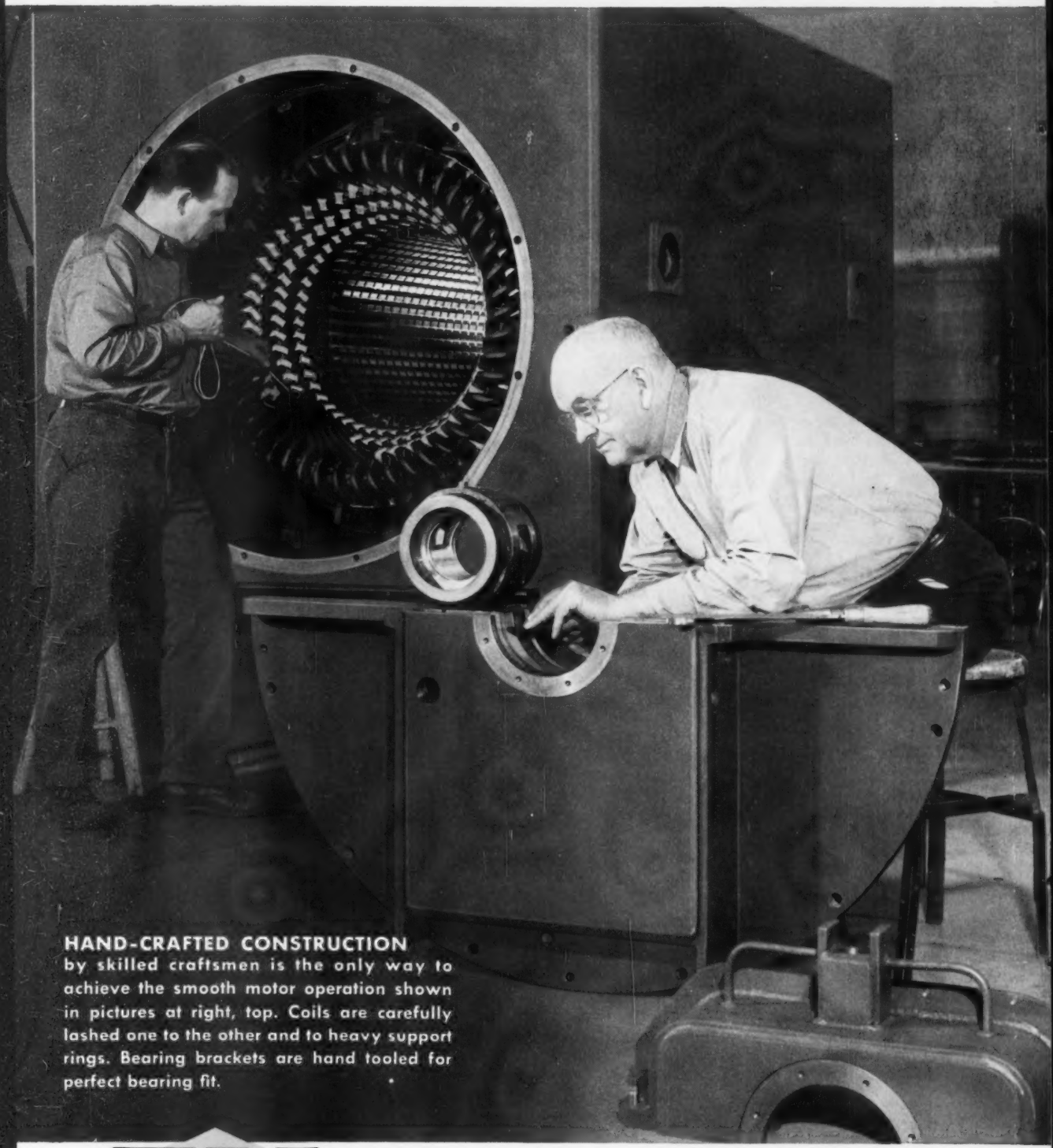
Hundreds of thousands of feet used at O'Hare Field

"Safety down under" with Kyova fiber conduit! O'Hare Field is equipped with thousands of underground electrical circuits designed to protect life and limb for many generations to come. Write today for more information on "jet age" fiber conduit.

KYOVA FIBER PIPE COMPANY
Ironton, Ohio

A look inside an E-M Straight-Up-Ventilated

A Smooth Running Motor



HAND-CRAFTED CONSTRUCTION by skilled craftsmen is the only way to achieve the smooth motor operation shown in pictures at right, top. Coils are carefully lashed one to the other and to heavy support rings. Bearing brackets are hand tooled for perfect bearing fit.

E-M

1300-TPA-2203

ELECTRIC MACHINERY

Builders of the new pump motor

Boiler Feed Pump Motor will show you

Doesn't Just Happen...

LISTEN CLOSELY. This running E-M Motor is not dead silent—just remarkably quiet. And when you stand near an E-M Straight-Up-Ventilated Motor, you aren't blasted in the face with hot air. Cooling air goes straight up.

NICKEL-ON-EDGE demonstrates fine balance of operating E-M boiler feed pump motor. Engineers visiting E-M factory learn Straight-Up-Ventilated Motor balance is far superior to usual commercial standards.

Quiet operation, precise balance result from E-M's imaginative engineering, thorough workmanship

The eye-opening boiler feed pump motor performance pictured above isn't confined to the test floor. It lasts for years. And E-M planned it this way because power plant engineers asked for it.

Yes, here is a motor that embodies those design features most wanted by power plant engineers:

1. Locked-in rotational stability that assures a lifetime of smooth operation.

2. Built-in acoustical control that makes the motor as quiet as the pump.

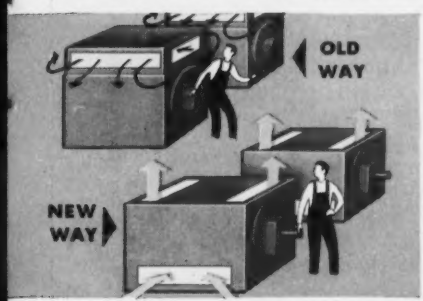
3. Top air discharge that carries ventilating air up and away—no recirculation or cross circulation to affect cooling of motors.

4. Easy access that enables one man to disassemble the motor for routine inspection without a hoist.

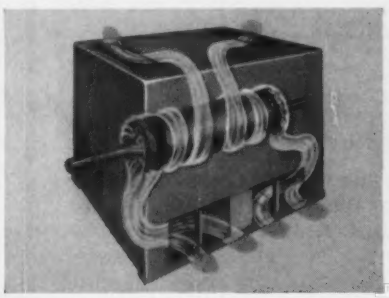
5. A low silhouette that lets you look over the motor to see other personnel and equipment in the pump room.

Your nearby E-M Field Engineer will be glad to give you complete details of E-M's finer motor construction. Call him, and write the factory for your free copy of the Straight-Up-Ventilated Motor Brochure No. 1134W.

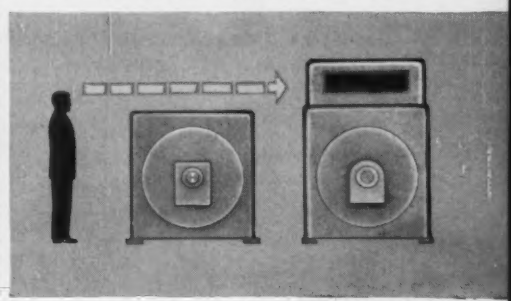
MANY BIG DIFFERENCES MAKE THE DIFFERENCE



STRAIGHT-UP-VENTILATION



AIR-FLOW ACOUSTICAL CONTROL



MINIMUM HEIGHT—MAXIMUM VISIBILITY

MFG. COMPANY MINNEAPOLIS 13, MINNESOTA

that performs as well on the job as on the test stand

1134P

Add years of life to in-service poles

Major savings in pole replacement costs are possible with a planned inspection and treating program using Chapman POL-NU. This superior grease-type preservative containing a full 10% pentachlorophenol restores natural losses of the original preservative in the critical ground-line area to add years of life to standing poles.

Pol-Nu Bandage-Maker slashes ground-line treatment costs

Maximum economy and effectiveness in the application of ground-line treatments are achieved with the Pol-Nu Bandage-Maker. This portable device prepares, as needed in the field, ground-line preservative bandages.

Improved Pol-Nu Pak

For those who prefer a factory-sealed, ready-to-use pole bandage, the Pol-Nu Pak offers real advantages. May be applied instantly by maintenance crews, is easy to stock and handle.

CHAPMAN®

POL-NU

and Pol-Nu Bandage-Maker

CHAPMAN CHEMICAL COMPANY

Leading manufacturer of wood preservatives

MEMPHIS 1, TENNESSEE

Palo Alto Cal. • Portland, Ore.
Minneapolis • Charlotte, N. C.

Mail coupon for complete data

Chapman Chemical Company
P. O. Box 138, Memphis 1, Tenn.

Please send your folder, "Preventive Maintenance For Poles", to:

Name_____

Company_____

Address_____

Photoelectric Control . . .

(*Continued from page* 109)

15,000 is protected by a rare-gas lightning arrester and by a fuse, though a non-fused model is also supplied. Light level is externally adjustable from 1 to 10 ft-c. Time delay device prevents auto headlamps from turning off controlled lighting.

Acme Wire Co, New Haven 14, Conn.

Wire Puller . . .

. . . for one-man operation is portable and hand operated. Porta-Puller pulls through conduit to 2 in. dia. Operator can use the 26-lb puller while standing on a ladder or lying flat in confined space. The device doubles as a portable winch or hoist.

Fairfield Industries, W Passaic Ave, Caldwell, N. J.

Epoxy-and-Glass Tubing . . .

. . . meets NEMA G-11 specifications. Dilecto GB-125EFR, made of glass cloth impregnated with epoxy resin, is furnished with inside diameters $\frac{3}{16}$ to 13½ in., length 38 in. It is flame retardatory and arc resistant.

Continental-Diamond Fibre Corp, Newark, Del.

*Trademark

Fine Fanner Superformed Products

"Superforms* make my Budget Dollars go farther" . . . PURCHASING AGENT

"We have to look at budgets as investments . . . in terms of *return* . . . all the way from negotiating and pricing, to having equipment available when needed for use.

"With Fanner Superforms, we get *prompt quotations* from the Agent and the Factory . . . they *meet their commitments* . . . give *reliable service.*"

These are reasons why more and more Purchasing Agents are buying more and more Superforms. A-1595A

FANNER Superformed with a "PROTECTIVE TWIST"

ARMOR RODS . . . Protect long-span T&D lines at supports

LINEGUARDS . . . Protect short-span T&D lines at supports

PATCH RODS . . . Repair damaged conductors

TAP ARMOR . . . Protects conductor at tapping points

FANNGRIPS . . . For dead-ending strands and conductors

FANNSPLICES . . . Join two ends of conductor wire

PLASTIC PRODUCTS . . . For conductor surface protection

FANNER

The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

Cost-cutting step taken 26 years ago still paying off at Hamm Brewery —they chose NONPAREIL Turbine Oil

Situation: In 1934 the Theo. Hamm Brewing Company installed two 1,000 kw. turbines. The brewing firm wanted to be sure there would be no downtime due to failure of the lubricant. Neither did the company want to spend time checking the oil's performance or adding new oil to sweeten the old.

What was done: Brewery management followed the advice of the Standard Oil lubrication specialist. They installed NONPAREIL Turbine Oil, the only oil, then as now, that carries with each fill a life-of-turbine guarantee.

What has happened: In 26 years since the turbines were put in service there has never been any downtime due to lubrication problems. In 1947 a 2500 kw. turbine was added to the system and another 3000 kw. unit was put in service in 1953. These, too, have used NONPAREIL Turbine Oil with the same results.

What you can do: Get the full story on NONPAREIL Turbine Oil from the Standard Oil office near you in any of the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

Quick facts about **NONPAREIL Turbine Oil**

- Will not permit formation of harmful acids
- Will not permit formation of sludge or oil varnish
- Will maintain good demulsibility or water separating characteristics
- Has high resistance to foaming
- Contains adequate rust inhibitor

You expect more from **STANDARD** *and you get it!*

Hamm Brewing Co. assistant chief engineer Steve Wappel and Standard's Dick Anderson discuss recent oil analysis. Dick Anderson knows his way about an industrial power plant. He's been providing customers with technical service on lubrication for five years. Dick has an engineering degree from the University of Minnesota and has completed the Standard Oil Sales Engineering School.

Readers Service

For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:

NEW EQUIPMENT

National Cash Register . . Computer ☐
Petersen . . . . . Tensioner ☐
General Electric . . . . . Switch ☐
Westinghouse . . . . . Transformer ☐
Vickers . . . . . Rectifier ☐
Advanced Instrument . . . . . Data Recorder ☐
Ingersoll-Rand . . . . . Hoist ☐
Beckman . . . Chloride Ion Analyzer ☐
Allis-Chalmers . . . Overcurrent Trip ☐
Acme Wire . . Photoelectric Control ☐
Fairfield . . . . . Wire Puller ☐
Continental-Diamond . . . . . Epoxy Tubing ☐

OTHER

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Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

* Note: Requests must be received within four weeks of publication date, accompanied by complete information specified. This service cannot be offered to readers in foreign countries or to competitive manufacturers.

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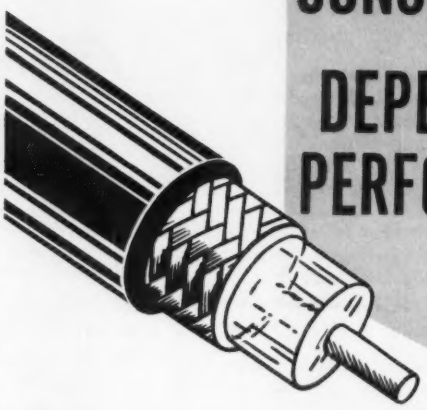
Specs . . . . . ☐
Trial . . . . . ☐
Purchase . . . . . ☐

MAY 23, 1960

HIGH QUALITY CONSTRUCTION
Assures
DEPENDABLE PERFORMANCE



OF
SUPERIOR
Coaxial Cables

SUPERIOR RF Cables consist entirely of high-quality components fabricated to uniformly high standards.

Conductor insulation and dielectric material is polyethylene for maximum operating efficiency, making these cables especially adaptable to applications requiring high, very high and ultra-high frequencies.

Typical examples of SUPERIOR Coaxial Cables:

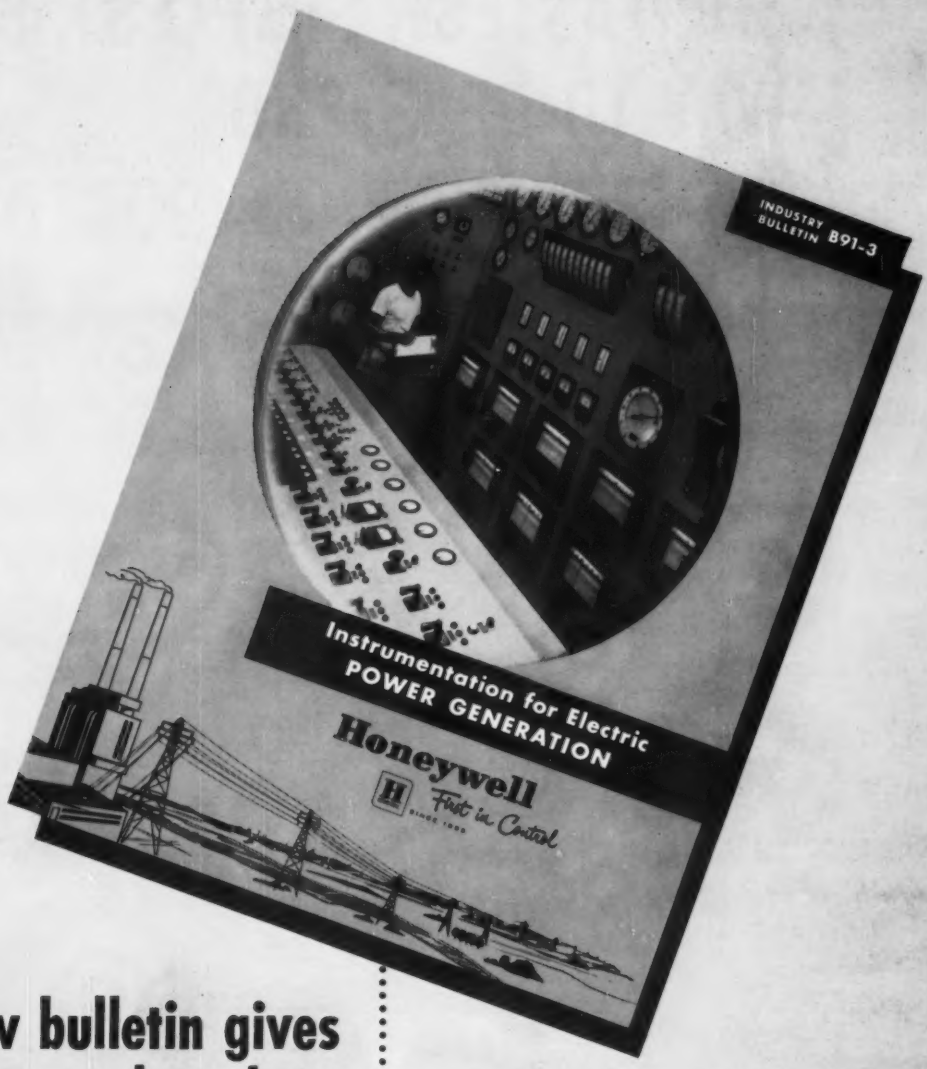
Army-Navy Type No.	Dia. of Dielectric In.	Nom. IMP. OHMS	Attenuation DB/100 ft. 400 Mc	3000	Shielding Braid	Nom. Overall Dia. In.
RG-8A/U	.285"	52	6	19	Single Copper	.405
RG-9B/U	.280"	50	6.1	21.8	Double Copper	.420
RG-11A/U	.285"	75	5.2	18.5	Single Copper	.405
RG-13A/U	.280"	75	5.7		Double Copper	.420
RG-17A/U	.680"	52	2.8	11	Single Copper	.870
RG-59A/U	.146"	75	9	30	Single Copper	.242
RG-74A/U	.370"	50	4.3	14	Double Copper	.615

All SUPERIOR Wires and Cables are quality-engineered and precision-manufactured to meet the exacting requirements of the industry.

For complete information and prices, write

SUPERIOR CABLE
SUPERIOR CABLE CORPORATION
Hickory, North Carolina

4737



New bulletin gives you complete data on power plant instrumentation!

You'll find this new 64-page catalog jam-packed with valuable instrumentation data. It covers all types of controls for boilers, turbines, engines and generators in central stations. It includes basic circuit diagrams and informative descriptions of a variety of specific applications. Detailed specifications are included as a handy guide to selecting recorders for volts, amperes, watts, vars, frequency, time deviation, temperature, pressure, flow and level.

Write today for your copy of Catalog B91-3. It's yours without cost or obligation.

MINNEAPOLIS - HONEYWELL

Wayne and Windrim Avenues, Philadelphia 44, Pa.

75th YEAR
PIONEERING THE FUTURE

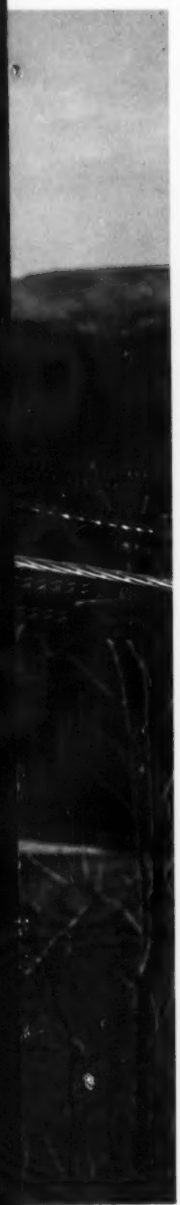
Honeywell
First in Control
SINCE 1885

THE FASTEST, SIMPLEST, SAFEST WAY TO DEAD-END DISTRIBUTION CONDUCTORS

Philadelphia Electric Company lineman dead-ends 4/0 ACSR conductor with PREFORMED Aluminum Dead-End. The down guy is of ⅜ galvanized steel strand with GUY-GRIP dead-end.

Patented—U. S. Patent No. 2,761,273.

With *Preformed* TRADEMARK CABLED LOOP DEAD-ENDS



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1. The most economical Dead-End available
2. UNIFORMITY OF ALL APPLICATIONS
3. Elimination of high stress concentrations
4. Extra holding strength to withstand ice loading and ice dropping
5. Faster, safer application... with ONE-PIECE Preformed DEAD-END

WIDE AREA SUPPORT with continuous line carry

Write for Booklet-of-the Month "Another New Twist"

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short term vs. the long look

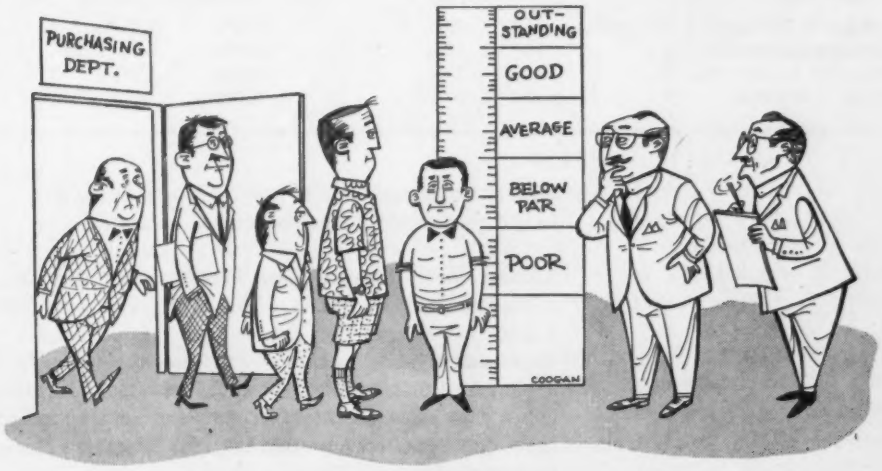
No utility is about to lose interest in the invoice price of coal. But as the power needs . . . and the resulting coal needs for the next ten and twenty years shape up in every operating area . . . short term thinking is giving way, more and more, to the *long look*.

Utility engineers and purchasing agents are asking themselves and their coal suppliers some pointed questions: "Can we count on these suppliers to deliver the kind and quantity of coal we're going to need in the years ahead? Have they adequate reserves? Is this coal costing us over and above its invoice price in excessive coal handling, ash handling, equipment outages, freight charges on inerts? Or is it coal that eliminates these frequently overlooked incremental costs, delivers highest operating efficiency and steam at the lowest cost?" The answers you'll get to such questions from Island Creek are the kind that let you plan ahead with confidence. Our engineers would welcome a chance to sit down with yours for a thoroughgoing discussion. Write, wire or phone.

You can depend on Island Creek . . . a career company dedicated to coal

ISLAND CREEK
Precisioneered Coal

ISLAND CREEK COAL SALES COMPANY, Chafin Building, Huntington 18, West Virginia • Chicago • Cincinnati • Cleveland • Detroit • Greensboro • New York • Pittsburgh



Does Your Purchasing Measure Up?

Report on **Purchasing**

The typical utility buyer spends over $30,000 a day. In the course of seven or eight working hours he makes about 20 buying decisions—often involving complex alternatives and outside advice. Clearly, he is a busy man. But is he as effective as he might be? That's what Connecticut Light & Power's F. M. Reinhold wanted to find when he made a 37-company survey recently. He presented his results at EEI's Purchasing & Stores Committee meeting in Philadelphia earlier this month. His paper, called "Organization for Effective Purchasing," revealed some thought-provoking patterns in the industry.

Reinhold found company size appears to have a pronounced effect on the apparent efficiency of a purchasing department. But big companies aren't necessarily more efficient than small ones. Efficiency seems to rise to a maximum as the number of customers approaches the 250,000 to 450,000 range. It slacks off in utilities that serve 450,000 to 1 million customers. And then it seems to snap back markedly in companies with more than 1 million customers.

How convincing are the figures? It is hard to say, Reinhold observed. His sample—admittedly small—included gas, gas-electric, and all-electric utilities. And the 37 companies polled showed wide variations in the jobs they expected of their purchasing departments. Some did traffic work. Some purchased merchandise, while others also purchased merchandise service parts. A few were decentralized. And some departments didn't process invoices. Nevertheless, the results are interesting indeed. Notice that in almost every case, companies with 250,000 to 450,000 customers, and those with more than 1 million customers, appear to enjoy an advantage (top of next page).

These additional facts came to light as well. (1) The vast majority of utilities (35 out of 37) centralize their purchasing. (2) Many purchasing departments have wide-ranging activities; in the sample, 19 purchased boiler fuels, 20 had responsibility for stores operation, and 31 had traffic departments under their control. There were also some major shortcomings; 15 utilities lacked a job description for the head of purchasing. And just four had drawn up a purchasing

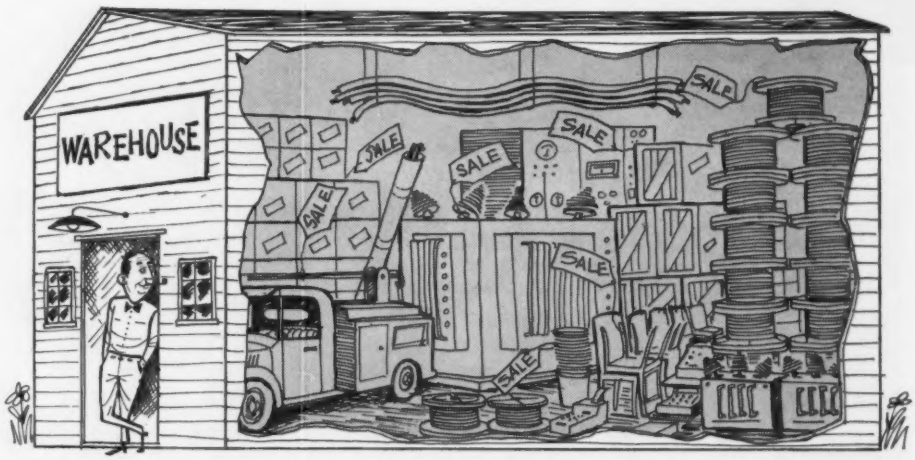
Check this survey of 37 utility purchasing executives . . .

Company Size by number of Customers	Customers per Company Employee	Customers per Purchasing Employee	Employees per Purchasing Employee
40,000 to 250,000 (14 companies)	132	21,230	164
250,000 to 450,000 (9 ")	167	34,000	226
450,000 to 1,000,000 (8 ")	129	26,000	201
Over 1,000,000 (6 ")	159	46,900	294

manual (incidentally, most wanted help in doing so). Furthermore, 21 utilities lacked established calling hours for salesmen.

At best, these statistics point direction. But they should not be underrated; to measure performance is to improve performance, Reinhold believes. Once a department's operation has been put into perspective by measuring efficiency, improvement seems to naturally follow. In what way? A completely integrated department that handled all areas of materials management, for example, appears to offer important economies. And better training probably would have a greater effect on a purchasing department's efficiency than anything else, he observed.

The ideal seems to be employing just enough of the right kind of well-trained people, working hard enough to meet the day-to-day demands of the depart-



68 Utilities Eye Their Disposal Woes

Report on
Disposal

Nuisance is one of the costs of progress. As systems grow, unused equipment often piles up alarmingly. Less efficient equipment must be phased out of service. And obsolete equipment undergoes a constant weeding-out. The disposal process is often as costly as it is bothersome for all. But many utilities have made a remarkable success of it. As evidence, an interesting cross section of industry views on the entire disposal problem was presented by J. F. Estill Jr, Houston Lighting & Power Co, at EEI's Purchasing & Stores committee meeting this month. Estill, who chaired a six-man committee for the task, presented the results of a 68-company survey. Here are their findings.

How does your purchasing department measure up?

Number of clerks per supervisor (buyers considered supervisors)	Orders Written per Purchasing Employee	Average Size of Purchase Order	Percent of Companies that Sell & Service Merchandise
2.21	1,556	$ 960	47
3.02	1,714	1,554	23
2.30	1,177	1,612	25
3.42	1,393	1,840	33

ment. But this is a delicate balance. Reinhold's figures indicate that purchasing departments spend about one-third of all the money paid out by the average utility. With figures like these at stake, an overworked buyer who takes shortcuts, who doesn't have time to explore all opportunities of better prices and lower transportation costs, can be a very expensive employee.

Here are six suggestions Reinhold advanced which may be helpful. (1) Hold regular meetings of supervisors to improve communications. (2) Give talks before other department groups; offer them a chance to discuss and clarify purchasing procedures. (3) Encourage key people to take trips to suppliers plants, and around the company system as well. (4) Hold communications courses in the department and in the company. (5) Obtain membership on standards committees; work earnestly for improved standards. (6) Pay attention to the company safety program.

Unused surplus equipment is a common woe for all utilities. It includes material, perhaps, left over from a construction job. Or it might be an over-supply in stores. In any event, it is a result of over-ordering, changes in plans and the like. Few classes of equipment are excluded, except for the most specialized items, such as major power plant equipment, buildings, transportation equipment, and office equipment. The unused items most frequently put up for sale, the study showed, are (1) Pole line hardware, (2) Overhead conductors, (3) Insulators, (4) Connectors and substation fittings, (5) Pipe, and (6) Valves.

How do most utilities dispose of it? By all odds, the most effective method is to simply return it to the original vendor—the method used most often by 44 companies. As very poor runners-up came used equipment dealers and other power companies. Fortunately, most of this equipment is in reasonable demand and can be disposed of at a fair price—except for substation steel, air break, and disconnect switches, and cable for use in underground construction.

The utilities claimed an amazing spread of resale values for their unused equipment (in terms of present-day prices). One company said it could reclaim only 10% on unused equipment resale, while another claimed a full 100%. Most, though, said they averaged an 80% return, and the weighted average return for all was 68%. Is this good or bad? Of the companies that replied, 41 said they were satisfied; only 16 said they were not. Interestingly enough, the "satisfied" utilities were averaging a 74% return on resale, while the "dissatisfieds" were getting only 48%. Those that were dissatisfied had real cause to be. But they also have real room for improvement.

Improvement, according to the utilities that needed it most, is likely to come from actions along these lines: (1) Discourage operating people and engineers from ordering excess material for special jobs. (2) Move fast; list surplus new equipment for sale as soon as it is available. (3) Never combine used equip-

ment with unused. (4) Establish a reputable clearing house to handle listings for all utilities.

Used equipment, of course, is another matter. This is not obsolete equipment—it can still be put to good use. There is simply too much of it on hand. A company might be converting from a 4-kv to a 12-kv distribution system and find itself with piles of perfectly useable 4-kv insulators, as one example. And **there are many more. Almost** every type of equipment, in fact, can be found in this category. Predominating are: (1) Distribution transformers, (2) Office equipment, (3) Meters, (4) Motors, and (5) Power transformers.

Here, used equipment dealers are the heavy favorites as an effective market. But other power companies also stand out, while electrical contractors and industrial companies are a marginal possibility. By a slim majority, the utilities polled said their used equipment was not in regular demand, and therefore not disposable at a fair price. One company, in fact, admitted it got only a 5% return on resale. But another company said it averaged 85%, and the weighted average for the group was 29% of present market price.

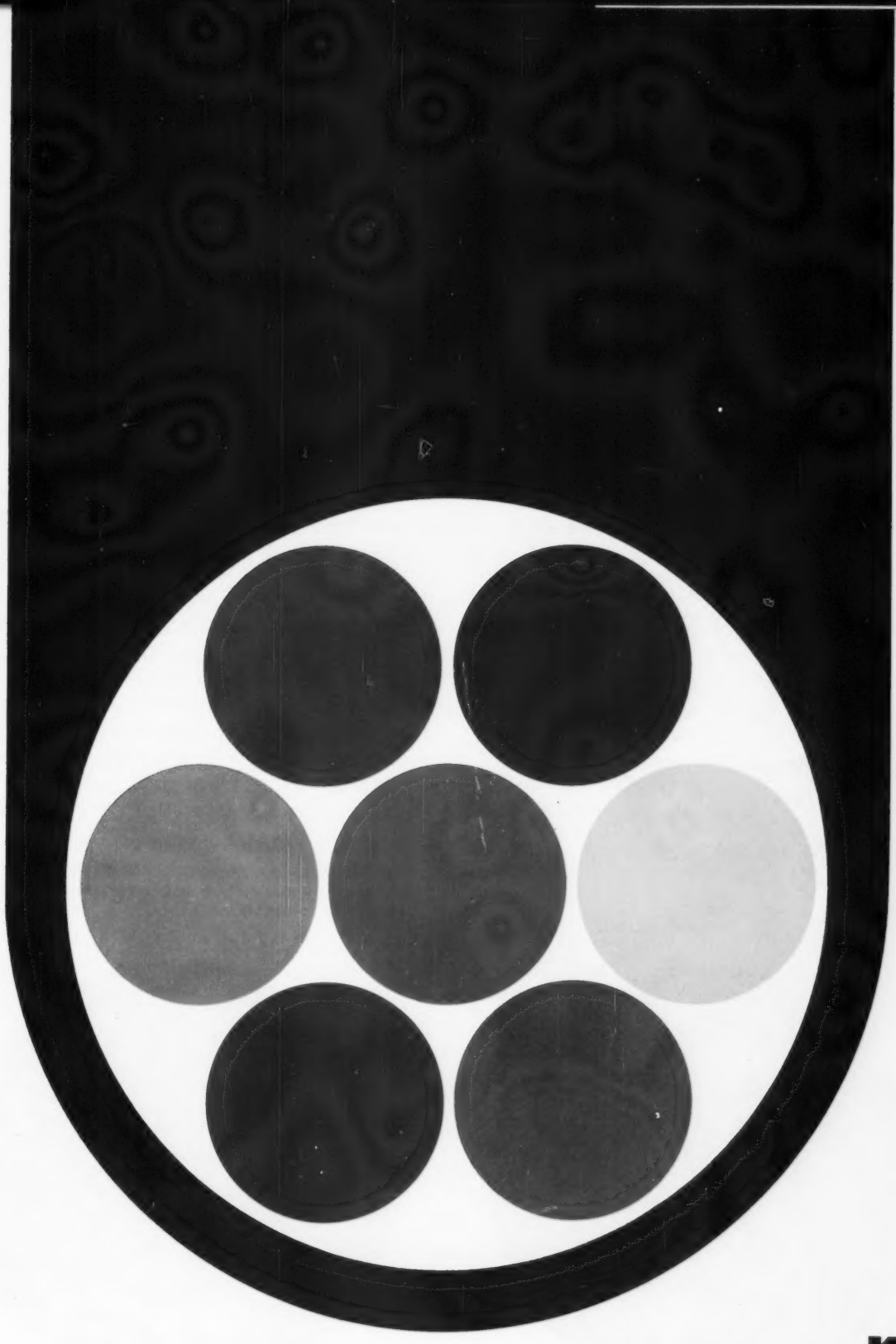
Many utilities are apparently discouraged about the possibilities of used equipment disposal. However, there is plenty of room for improvement. Here are a few suggestions from the utilities themselves. (1) There is a considerable amount of remaining life in many items. Somewhere, there must be a better market for it. (2) Used equipment dealers that specialize in a given type of material are most helpful. (3) There is a need for a reputable clearing house to handle listings for all utilities. (4) An organized procedure is needed; more time should be spent on disposal.

Last of all comes obsolete equipment; equipment that could still serve its purpose, but which has lost its usefulness to the owner. Although it is not scrap, it misses that classification by little more than a hair. Utilities are always busy selling all types of obsolete equipment, often in sizeable quantities. Old meters head the list, but they are followed so closely by many other items that it is impossible to say any one predominates. Used equipment dealers are far and away the most popular market for this equipment, with other power companies in a distant second place, and almost all other routes of disposal closed.

Most agreed that obsolete equipment was not in demand and seldom brought a fair price. What is it bringing on the market? Replies ranged from 5% to 50% of present price, with a weighted average of 19%. Most considered this adequate, but 20 companies said they were dissatisfied with the prices they were receiving. Their suggestions: (1) Concentrate on nearby markets to save on transportation and inspection costs, (2) Establish a regional listing agency to generate more interest in the equipment.

The central clearing house idea came up as a suggestion for improving sales to other utilities in every category of equipment resale. However, Estill pointed out that the idea appears unrewarding. In the survey, utilities were against buying a significantly greater amount of unused surplus under such a system by a 40 to 24 margin. They were also against boosting used equipment purchases by 55 to 12, and doubted they would buy more obsolete equipment by an overwhelming 60 to 4. It appears that a central clearing house would result in little or no improvement except, perhaps, in moving unused surplus.

In spreading the word of equipment for sale, most utilities use a personal letter, a form letter, or a bid form. Five companies used telephone calls in some cases, and six advertised in publications. To set price, 90% of the companies polled use competitive bidding. Only one in ten fixes price when the sale is announced, and those that do have no set formula for arriving at a value.



IN ELECTRICAL WIRE & CABLE . . . **THE SPARK OF QUALITY IS KAISER WIRE EXPERIENCE**

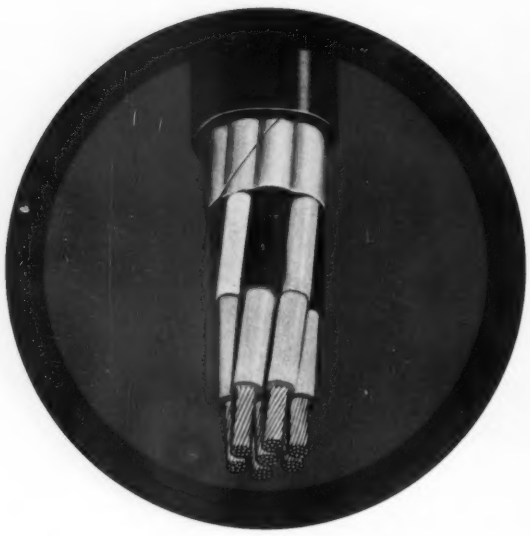
CONTROL CABLE... 28 YEARS OF PERFECT INSULATION SERVICE

KAISER MASTER LAYTEX® CONTROL CABLE has never known a reported insulation failure!...and the introduction of patented Laytex-Resin promises to improve upon this 28-year record of perfection!

Laytex-Resin is the combination of Laytex insulation with a specially-compounded resin layer over the insulation that eliminates the bulk of braided coverings. It brings the following advantages over extruded constructions:

Smaller diameter, to expand service without enlarging ducts...less weight...increased flexibility...proven greater insulation protection against acids, alkalies, flame, fungus, water, oil, ozone and light...uniform protection free of thin spots...can't wick moisture or fray...easier splicing...brighter color coding and longer lengths per reel.

SPECIFY 935-S. ASK FOR KAISER CONTROL CABLE BOOKLET.



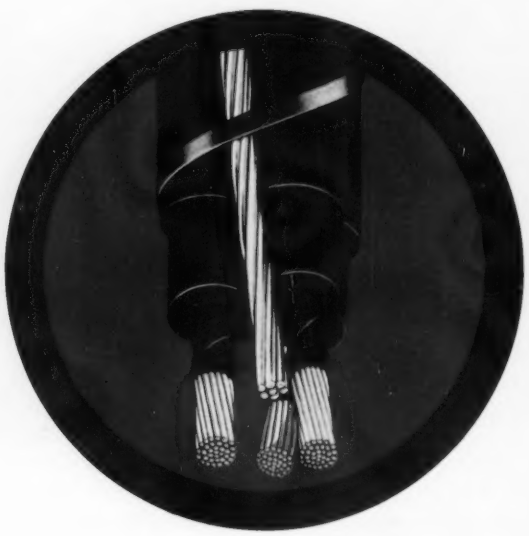
POWER CABLE... 16.4 TIMES MORE OZONE RESISTANCE

KAISER GRIZZLY® POWER CABLE is the only power cable to resist 6000 hours of high ozone shock test—outlasting 9 leading brands tested!

Several samples of each unshielded 5KV cable were placed with a "U" bend resting on a grounded metal plate. A conductor-to-plate potential of 40,000 volts was applied until all cables failed. Four brands failed immediately. The last competitor gave out 432 hours before the first Kaiser cable. Kaiser Grizzly samples went on to last over 6000 hours . . . 16.4 times longer than the test average of best performances . . . 2.4 times the life of the nearest competitor.

The reason: A superior combination of Kaiser insulation and jacketing. In power cables it represents a major victory over the main cause of failure—dielectric breakdown due to ozone.

AVAILABLE IN A WIDE RANGE OF SIZES AND SPECIFICATIONS FOR OVERHEAD AND UNDERGROUND HIGH-VOLTAGE APPLICATIONS.



K/W EHV...1000 MILES OF 345KV...MUCH MORE IN THE FUTURE

KAISER ALUMINUM EHV CONDUCTORS span more than 1000 of the 2500 miles of extra high voltage transmission lines now in service in this country.

As system voltages of 345KV, 460KV and higher become more common, Kaiser offers specialized conductor design, manufacturing, and installation experience.

Kaiser engineers are actively engaged in utility experimental EHV installations...field measurements of corona loss as it affects radio and TV interference . . . bundled conductor and accessory analysis . . . problems of galloping conductors...vibration and tension studies . . . and other research toward better conductor design and installation.

As a result, standard paper expanded core conductors—as well as such designs as hollow core, "I" beam, and tubular expanded core—have been manufactured and subjected to torturous field installation procedures for evaluation.

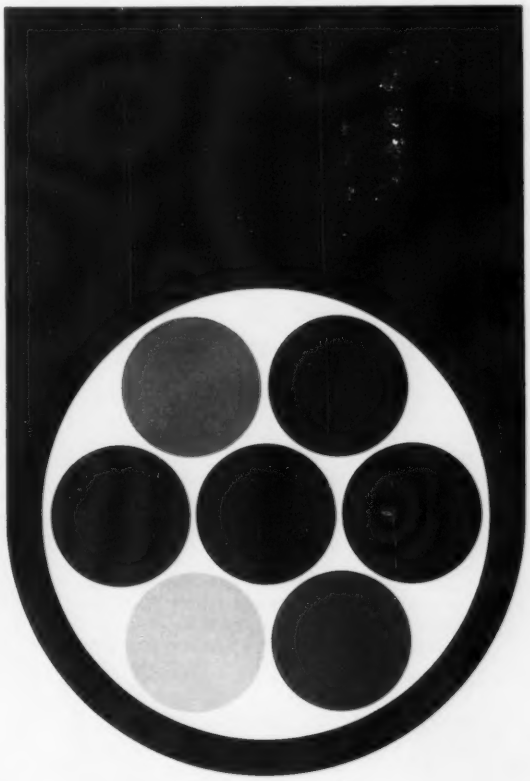
IN ELECTRICAL WIRE & CABLE THE SPARK OF QUALITY IS K/W EXPERIENCE

The spark of quality means positive—often dramatic—savings in service for those who will specify Kaiser wire and cable.

Among the world's leading electrical wire and cable producers, only Kaiser is heir to the 70-year experience of a major rubber company in developing insulation and jacketing compounds.

Insulations such as Laytex®, Laytex-Resin, Hydrosec® and Kalzone give greater utility, longer life to a complete range of aluminum or copper conductors. For immediate service in any type of wire or cable, call your K/W Distributor or Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center, 300 Lakeside Drive Oakland 12, California.

KAISER ALUMINUM



CHALLENGE!

CAN WE MEET THE NEW COMPETITION?

"In the forty years that have elapsed since its Revolution, Russia has devoted a far larger portion of its gross national product to education than have we. As a result of this intense commitment to education on the part of the Soviets, we as a nation are presented for the first time with a challenge to our leadership in all of the values that we cherish.

"If we rightly interpret the significance of this event, our first reaction of dismay and consternation will herald a rededication of ourselves to the best that we have learned from our first century of educational effort. We have a longer and a stronger tradition, greater resources in depth and diversity, a freedom of enterprise, and a talent for innovation which can all combine to more than redress the present balance and carry us to new heights of educational accomplishment if we display the requisite wisdom and determination."

GAYLORD P. HARNWELL
President, University of Pennsylvania

WE CAN AND MUST MATCH THEIR ZEAL— because our strength as a nation will depend on how we treasure and build our educational assets. Yet the hard facts are these:

1. Low salaries are not only driving gifted college teachers into other fields but are steadily reducing the number of qualified people who choose college teaching as a career.

2. Many college classrooms are already overcrowded yet in less than ten years entrance applications will double in number.

You can help in this crisis, one of the gravest in our history. Support the college or university of your choice—now!

For further details of what this can mean to you and your children write:
HIGHER EDUCATION, Box 36—Times Square Station, N. Y. 36, N. Y.

Sponsored as a public service in behalf of
The Council for Financial Aid to Education

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HIGHER EDUCATION
KEEP IT BRIGHT

IMPROVED STREET LIGHTING helped Fargo, N. D., receive honor as an All-America city. New luminaires provide five times as much light as old ones

Improved Street Lighting Ups Night Business

Further proof that improved street lighting not only cuts down the number of traffic accidents and crimes, but contributes to increased nighttime business as well, is evidenced by recent metropolitan installations.

New street lighting in Fargo, N.D., also helped in its selection as one of the 11 All-America cities recently chosen by the National Municipal League.

In Dubuque, Iowa, the attraction and convenience of a well-lighted area has stimulated cash registers to ringing from increased after-dark sales.

Up-dated lumination has made Pontiac, Mich., "a brighter and more cheerful downtown area."

Installation of 66 fluorescent street lighting fixtures in Fargo are providing almost five times as much light as the previous luminaires. The six-ft, 4-lamp flourescents provided almost 6 foot-candles when initially turned on. Lighting now varies with the width of the street, but 3.97 ft-c is the averaged maintained illumination.

The luminaires were mounted 40 ft apart, 30 ft high, on davit-type steel poles.

Fargo merchants have noted a perceptible increase in night business and this must be attributed to the new brillantly lighted main street, according to Mayor Herschel Lashkowitz.

In Dubuque, the recently completed lighting system covers 27 blocks of heavily traveled streets. Six-lamp, 6-ft luminaires were installed on the main street, while similar 4-lamp, 6-ft units were set up in the remainder of the downtown area.

The new units are mounted four to a block, two on each side of the street, at a height of 30 ft, on steel, davit-type poles. Main street now has about 2.8 ft-c of maintained illumination, or five times the previous lighting. About 1.7 ft-c is maintained in the balance of the downtown area.

The project was initiated jointly by the Chamber of Commerce Merchants Committee and the City Council. Cost of the project is being borne by adjoining property owners at a charge of $10.09 per ft on the main street and $8.23 per ft on the other newly lighted streets.

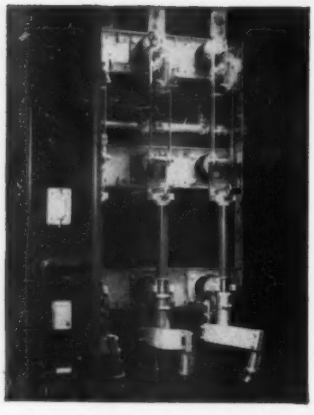
Total cost was $116,700, including some extensive rewiring.

In addition to the increased business, "new lights cut down crime and auto thefts to help build up the downtown area," said Kenneth Hartig, chairman of the Chamber of Commerce's Merchants Bureau. "This is another step in keeping our

(*Continued on page* 130)

NEW STREET LIGHTS in Pontiac, Mich., not only illuminate the pavement and sidewalks, but help brighten store fronts as well

SEES ALL YOUR FAULTS



Inside view of typical bay, showing load interrupter (for switching), power fuses, and out-going pothead.

A Power Fuse both senses and clears short circuits— cuts cost of metalclad switchgear 50%

With S&C Metalclad Switchgear you get dependable protection for your high-voltage power circuits at about half the cost. How? Partly through the use of S&C Power Fuses instead of circuit breakers and relaying.

The power fuse is self-sufficient. It needs no instrument transformers, no relay. There is nothing to set, adjust, test, or maintain. You don't need special equipment or skills. After the fuse clears the fault and the cause has been corrected, you simply reach for a $13.50 refill stored in the compartment door.

Power fuses give you the protection you need against permanent destructive faults. Industrial and commercial high-voltage power circuits are not subject to transient faults (such as lightning, falling trees, wind, ice, rodents) and so don't need the automatic reclosing feature of the circuit breaker.

S&C fused interrupter gear meets the new National Electrical Code requirements for fault closing. It is available in short circuit interrupting ratings up to 500 mva at 14.4 kv, 250 mva at 4.16 kv. Continuous current ratings are 200, 400, and 720 amperes. Maximum capacity of main bus, 2000 amperes.

S & C ELECTRIC COMPANY

4421 Ravenswood Avenue • Chicago 40, Illinois

Specialists in High Voltage Circuit Interruption since 1911

S&C

Improved Street Lighting

(*Continued from page* 127)

community progressive," he noted.

Pontiac, Mich., recently installed 80 fluorescent street lighting fixtures, part of a modernization program which began four years ago. The program has included one-and-one-half miles of arterial highway.

Six-ft, four-lamp units, mounted at a height of 30 ft and spaced about 120 ft apart on both sides of the street, provide 3 ft-c of illumination.

The units not only illuminate the pavement and sidewalks but also help brighten store fronts, according to G. E. Korten, Consumers Power Co street lighting supervisor, who, along with G. A. Low, helped design the system.

Electricity Sparks Carolina Rural Sales Increase

There's a revolution afoot down on the farm and it's sparked by electricity, according to H. G. Isley, general sales manager for Carolina Power & Light Co.

Since 1950 the company has erected 6,000 miles of rural lines. Today there are more than 20,000 miles of lines in the Carolinas. CP&L's 148,374 rural customers consume more than twice the amount of electricity they used 10 years ago. This and other growing power demands have prompted a CP&L plant expansion of some $254 million since World War II, Isley said.

Electricity even grows grass in the Carolinas. Several "grass incubators" on CP&L lines grow a crop of oats to 8-in. in height in a matter of six days by maintaining constant temperature, moisture and light. This operation actually brings the pasture indoors in all seasons of the year.

Also, one of the Carolinas' most delectable farm products, the country cured ham, also gets the electric treatment. Seasoning is not the whole story in ham curing; constant cool weather is a must. Farmers are now adding electric air conditioners and heat pumps to their "smoke houses" for year-round cooling.

Pool-side Displays Aid MH Program

Tampa Electric Co recently tied in its growing Medallion Home Program with a fashion show and electrical appliance display.

A Gold Medallion home located in the Winter Haven section was opened to the public at a one-day, three-showings, affair. Tickets were distributed free and limited to 100 guests for each showing.

Guests were seated in the air-conditioned living room, den and bedroom. All three rooms had sliding glass doors and faced the pool. Fashion show models used the terrace around the pool for a ramp. Appliances were placed along the terrace. The models paraded around the pool in front of each room, then posed next to an appliance as the narrator pointed out its features.

Guests were then invited into the dining room for refreshments and a tour of the house, with emphasis on the all-electric kitchen.

Tampa Electric Co certified 113 Medallion Homes during March. Thirty-six of these were Gold Medallion Homes; the remaining 77, Bronze. A total of 980 Medallion Homes have been certified in Tampa Electric's service area since the program began less than two years ago.

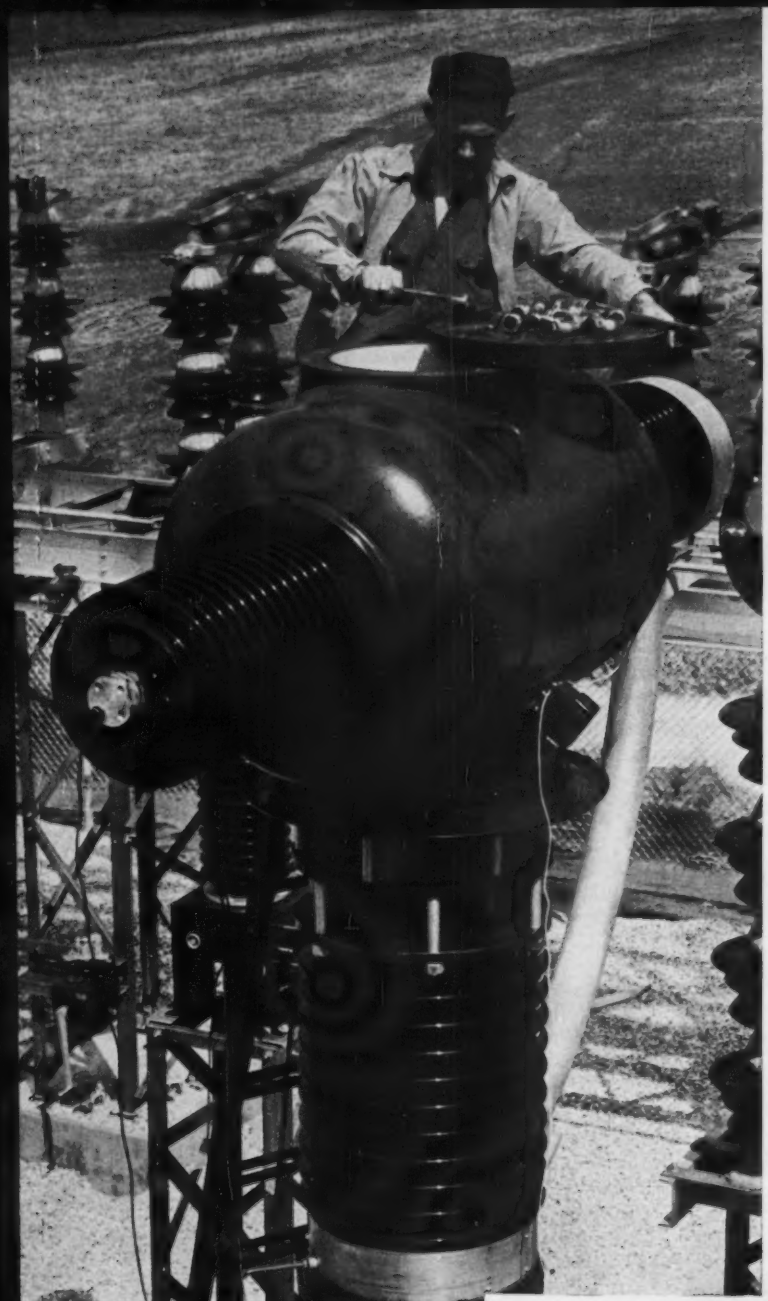
SELLING BRIEFS

Ten-page bulletin outlining the value of **floodlighting** is available from General Electric Co, Schenectady, N. Y. It discusses "how to get more light per dollar."

Instructional booklet covering **insulation** of electrically heated homes that present problems lying outside the scope of recently adopted minimum all-weather comfort standard is available from Forty-Eight Insulations Inc, Aurora, Ill. Eight-page booklet lists special requirements of ceiling-heated homes and those in which rates of air change or area of window glass are greater than values used for establishing All-Weather Standard.

Sylvania Lighting Products is marketing its version of an electroluminescent **night light.** Unit plugs into standard 120-v outlets, burns for a year for less than 3¢, has life expectancy of almost five years of continuous burning, and provides a light source 3½ in. in dia.

Electric **light bulb** reported to be shatter-proof has been developed by Duro-test Corp. "Flamescent" lamp has new shape bulb developed with a cooling crown to take advantage of a Fiberglas winding. Cooling chamber thus created lowers the filament operating temperature to eliminate brittleness and fragileness, manufacturer reports.



GENERAL ELECTRIC'S
AIR-BLAST DESIGN PROVIDES . . .

Drastically Reduced Maintenance For Power Circuit Breakers

General Electric air-blast power circuit breakers require maintenance only one-third as often as conventional breakers. And when they do, maintenance crews can complete their work in less than one-fourth the time.

Maintenance requirements are reduced because the fast interrupting action of G-E air-blast breakers greatly reduces erosion of contacts, probes, and orifices. Fast interruption occurs because high-pressure is stored in the interrupter head, and is available the instant contacts part.

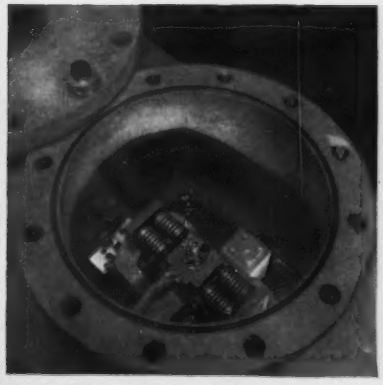
Normal inspection is simple and fast. It involves exhausting stored air from the breaker, swinging the interrupter access cover aside, and visually inspecting the contacts. If required, the complete operating mechanism can be replaced quickly with a spare unit.

In addition, G-E air-blast breakers can be installed in a fraction of the time normally required to install comparable oil breakers, and provide practical protection for transmission systems 115 to 460 kv and higher.

Why settle for less? Contact your G-E Sales Engineer for more information. Or write to Section 494-06, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC



CONTACTS ARE VISIBLE for inspection without removing any parts. If required, the entire operating mechanism can be removed and quickly replaced with a spare unit.

PS of Indiana Elects Three New VPs

Public Service Co of Indiana has elected H. A. Barker, financial vice president; H. B. Christianson Jr, vice president-Northern Division operation; and R. W. Rink, vice president-Western Division operations.

Barker had been assistant to the executive vice president. Prior to joining Public Service Co of Indiana, he was a principal with the public accounting firm of Haskins & Sells.

Christianson, who succeeds L. J. Evans, will be in charge of the operations in the company's Northern Division. Prior to joining the utility he was assistant to the vice president, operations, for the Chicago, Rock Island and Pacific Railroad.

Rink succeeds William M. Large, and will be in charge of operations in the company's Western Division with headquarters at Terre Haute. Rink had served in various managerial capacities in Colorado and California, and for three years prior to joining Public Service Co was City Manager at Toledo, Ohio.

BARKER RINK CHRISTIANSON

Schmidt Made Vice President of Consumers Power Co

Walter C. Schmidt (photo) has been made a vice president of Consumers Power Co.

Schmidt, who was formerly manager of engineering and construction, will have general charge of engineering, construction, land and right-of-way, purchases and stores, and coordination of consulting engineering services.

He joined Consumers Power as a junior engineer at Jackson, Mich., in 1924 and rose through various engineering assignments to the position of general supervisor of construction in 1950. He became manager of engineering and construction in 1957.

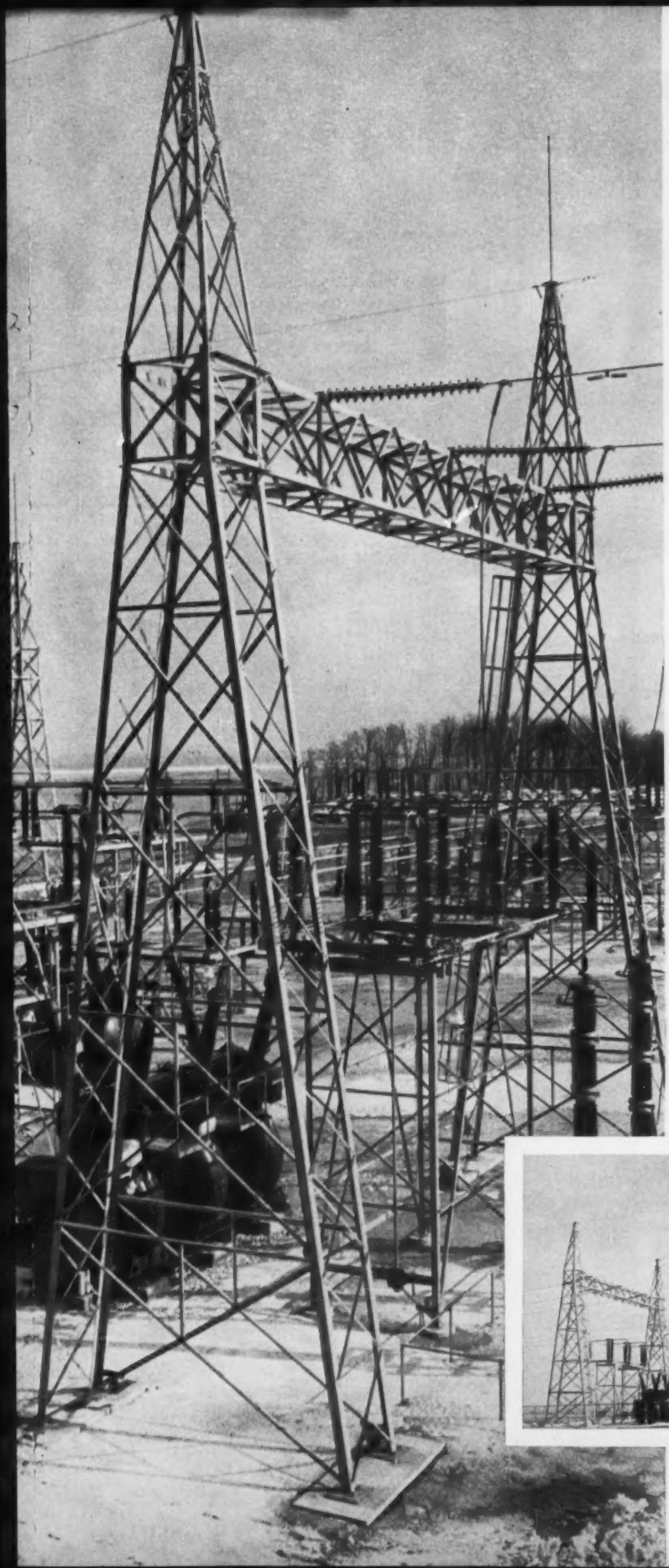
In another move, Robert D. Allen was named assistant to the president of Consumers Power.

Wagner Elects Widell a VP

Carl E. Widell has been elected vice president in charge of marketing of Wagner Electric Corp. He succeeds Harold N. Felton who will remain as a vice president in an advisory and consulting capacity.

Widell joined Wagner Electric in 1940. He worked in the main office and factory for two and a half years. Following his release from the Navy, he rejoined Wagner and in 1946 was sent to the company's Cleveland branch as a sales engineer. In 1952, he became manager of the Portland, Ore., branch. He was made director of research and development in the main office in 1956.

(*More News About People on page* 134)



GENERAL ELECTRIC'S VARIETY OF STRUCTURAL DESIGNS MEAN YOU CAN...

Meet Your Exact Station Requirements, and Save Installation Time and Money

General Electric's flexible approach to the design of outdoor stations permits an almost infinite variety of station layouts, while helping you save installation time and money.

An almost infinite number of station layouts is possible because of the variety of structural styles available. Latticed-column or rolled-shape structures are available in galvanized steel or aluminum. Stands, pedestals, trusses, and towers are available for mounting station equipment and components.

You save time and money, because delivery of structural items and other station components is co-ordinated with your installation schedule. There's no waiting, and yet no unnecessary handling and storage of parts.

Why settle for less? Contact your G-E Sales Engineer for more information. Or write to Section 495-10, General Electric Co., Schenectady 5, N. Y.

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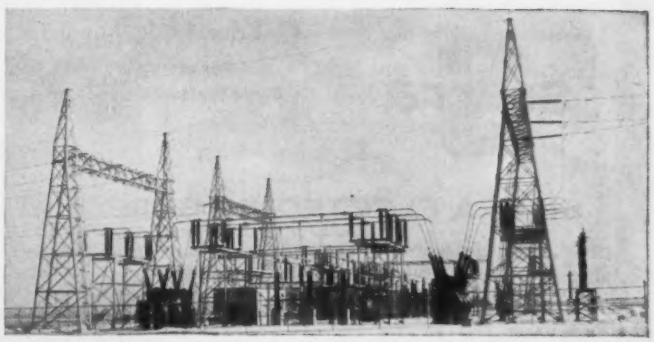
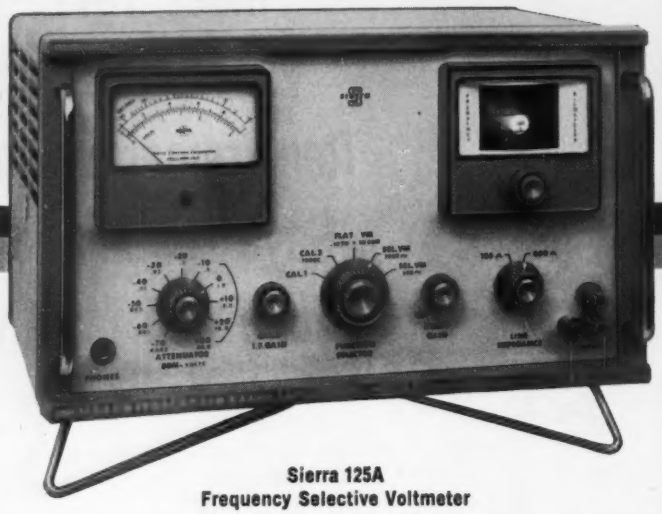


FROM A VARIETY OF STRUCTURAL STYLES offered by G.E., lattice-work structures were chosen for termination structures and equipment stands in the switching station for Unit No. 5 at the Oak Creek Power Plant near Milwaukee, Wis.

New Tunable Voltmeter is also flat AC VTVM covering 1 to 600 KC



Sierra 125A
Frequency Selective Voltmeter

As a frequency selective voltmeter, Sierra 125A covers 3 to 600 KC continuously on a 40" scale. An up-converter with high IF and single conversion keeps spurious responses down 60 db. Crystal lattices provide two steep-skirted IF bandwidths — 250 cps or 2.5 KC.

As an AC VTVM, Model 125A offers response flat within ± 0.2 db, 1 KC to 600 KC, and measurement accuracy of better than ± 0.5 db. This additional mode increases the instrument's versatility and facilitates measurements on carrier systems.

Measurement range is —90 to +32 dbm in selective mode and —30 to +32 dbm in the flat mode. Signal levels are read directly on either 135 or 600 ohm lines, balanced or unbalanced. Line bridging loss is less than 0.25 db over the entire frequency range. Built-in 100 KC crystal oscillator provides accurate reference for both level and frequency calibration. Modular construction and etched epoxy glass circuit boards provide ease of access and operating dependability.

Price, $895.00 f.o.b. factory.

For complete details, see your Sierra representative or write direct.

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Export: Frazar & Hansen, Ltd., San Francisco, Los Angeles 6563

PERSONAL BRIEFS

Joseph P. Callahan has been promoted to operating superintendent of the Northwestern Division at Pennsylvania Electric Co. **Robert P. Martin Jr** becomes manager in Meadville.

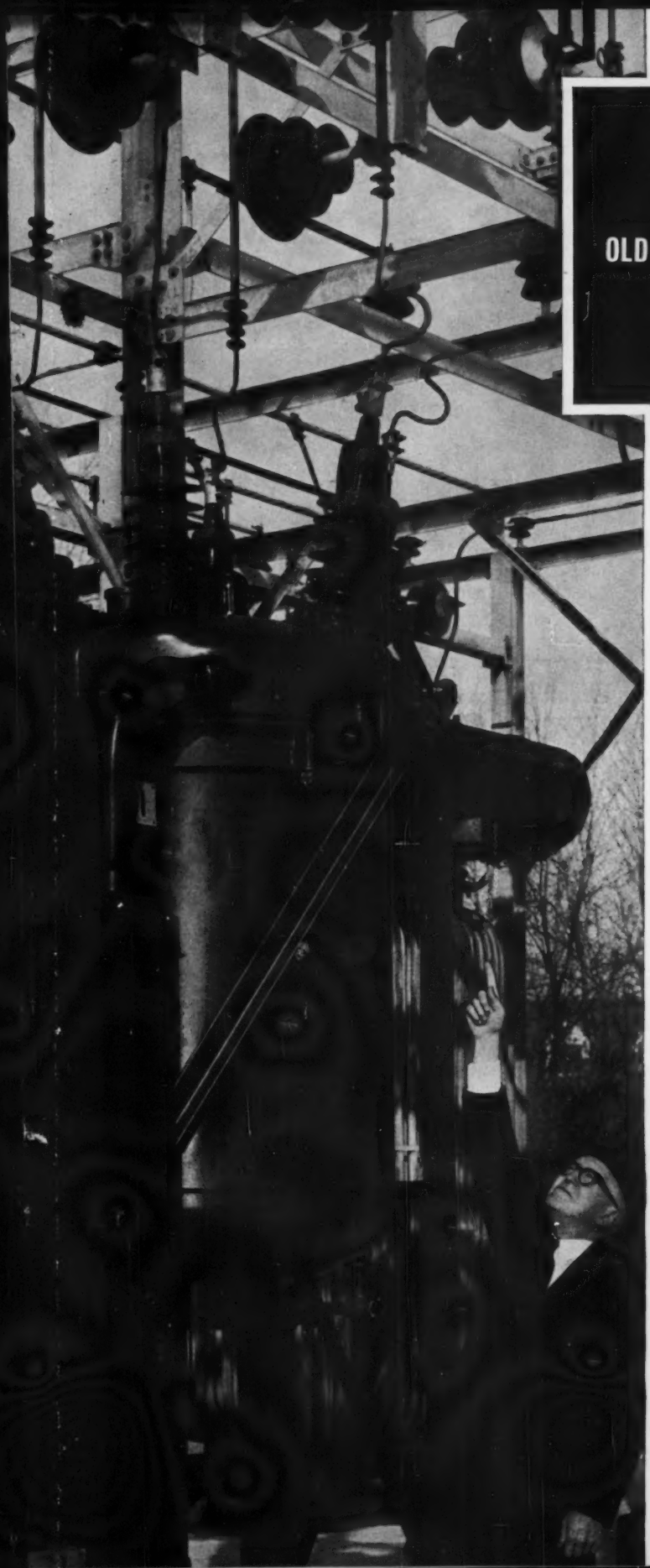
E. D. Sutcliffe, general manager of Western Development & Power Ltd, has been appointed to the board of directors of Peace River Power Development Co, Ltd.

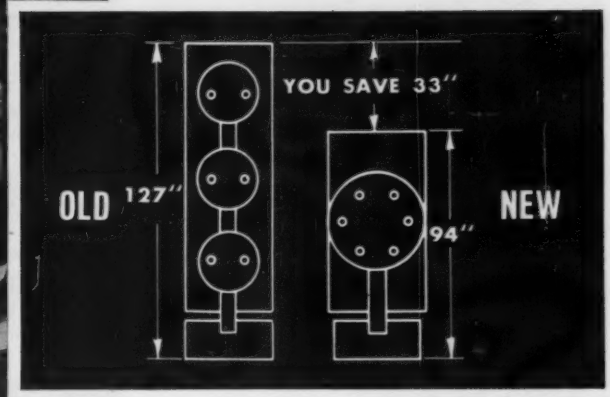
Central Maine Power Co has named **Thomas Michewich,** manager of the Skowhegan district.

As part of its management development program, two Illinois Power Co engineers have switched jobs. **George P. Wilson** became manager of electrical engineering, and **Theodore W. Schroeder,** manager of power production.

General Electric Co has established an Industrial Sales Operation with **S. W. Corbin** as manager. **M. J. Carroccio** has been appointed manager of distributor and home product sales, general purpose motor department; **Harold W. Burdekin,** manager of dealer sales for the electric major appliance sales and distribution department's Northwest district, replacing **Howard Oliphant** who has transferred to Salt Lake City; **George S. Trotter,** manager of the Western sales region of the large lamp department; **Raymond H. Rogers,** manager of marketing for the specialty transformer department, succeeding **Joseph P. Couglin** who has been named a regional manager in the components sales operation; **Fred A. Hollenbach,** project manager for the nuclear power plant which the atomic power equipment department will furnish Consumers Power Co.

L. Berkley Davis, general manager of the Electronic Components Division, has been elected a vice president. **Erwin R. Summers,** senior development engineer in the medium AC motor and generator department, has been given a special Award of Merit. **Howard A. Frey** has been appointed general manager of the insulator department, not general manager of engineering as was incorrectly reported in a recent issue.
(*More News About People, p* 136)





Comparative dimensions of G-E one-tank and conventional three-tank breakers rated 34.5 kv, 1200 amps.

WITH GENERAL ELECTRIC ONE-TANK SUB-TRANSMISSION BREAKERS, YOU CAN . . .

Reduce Space Requirements and Installation Costs

Space requirements and installation costs are substantially reduced with General Electric one-tank sub-transmission breakers.

Because G-E breakers accommodate all phases in one tank, they weigh at least 700 pounds less than three-tank units of the same rating, and require 25% less space.

Compactness and light weight mean that G-E one-tank breakers can be mounted on smaller foundation pads, saving you material and excavation costs. Considerable savings in overhead buswork can often be realized, too.

General Electric one-tank breakers are shipped with all components in place—you need only position the breaker and make necessary service preparations.

Why settle for less? For more information on one-tank breakers (15 kv through 46 kv), contact your G-E Sales Engineer. Or write to Section 494-03, General Electric Company, Schenectady 5, N. Y.

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4. Long Life
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For more than 50 years *Crapo* Galvanized Steel Strand has consistently demonstrated its ability to more than meet all of these requirements. Proof of its reliable performance is to be found in the case histories of overhead power and communication lines throughout the country.

Crapo Galvanized Steel Strand is fully protected against corrosion by heavy, uniform, dense coatings of commercially pure zinc tightly bonded to the individual wires. All grades and sizes are available in A, B and C weights of coating.

For details, ask our distributor or write direct!

INDIANA STEEL & WIRE COMPANY, INC.
Muncie, Indiana

SALES ASSIGNMENTS

COMPANY STAFFS

Allis-Chalmers Manufacturing Co has appointed the following to sales posts: Charles F. O'Riordan, manager, North Central Region, Industries Group; Robert E. Morris, manager of the Midwest region; J. A. Sudduth, manager of the St Louis district; William S. Wright, manager of the Grand Rapids, Mich., district.

Graybar Electric Co Inc has made the following appointments: J. L. Bevers, manager at Omaha; L. S. Smith, manager at Wichita; H. J. Van Westenberg, sales manager, Colorado Springs; F. M. Sholders, manager, Midwestern district; H. E. Wilkinson Jr, Buffalo manager; and J. A. Cassin, Central district financial manager.

Sylvania Electric Products Inc, Sylvania Lighting Products Division, has made L. John Doyle Midwest regional sales manager.

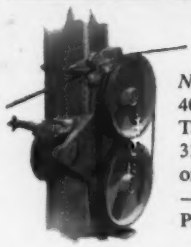
C&D Batteries has transferred Eugene L. Krauss to the Washington sales office. He comes from the Atlanta office of Mark C. Pope Associates, C&D's sales organization. Zane W. McColloch has joined Robert H. Welf & Associates, Inc, C&D's Cleveland, Ohio, representatives.

REPRESENTATIVES

D. W. Onan & Sons, Inc, has named Onan Eastern Corp, exclusive distributors for New York City, northern counties of New Jersey, and Connecticut. Executives are: Ralph Siegel, president; Martin Taylor, vice president and sales manager; and Leonard Freeman, assistant secretary and sales engineer. The company will carry Onan electric generating plants up to and including 10,000-w capacity units, and will be located at 21-34 Broadway, Long Island City 6, N.Y.

Brown Co, Bermico Division, has appointed William E. Welter, southwestern sales representative. His territory will include Texas, Oklahoma, Arkansas, and Louisiana, with headquarters in Dallas.

NEW PENGO POLE-MOUNT TENSIONER



Now...PENGO 4000 Tensioner Takes Conductor to 336,500 cm-ACSR or 397,500 cm-AAC —Tensions to 1,000 Pounds!

Here's a bullwheel tensioner you can carry in every line truck! It features two 18 inch neoprene lined bullwheels. Tru-Stop disc brake – yet weighs so little it's truly portable.

Two men can easily place the 4000 PM against the pole, attach it (chains and wing-nut tightener are permanently attached to tensioner), and start stringing in a matter of minutes. Conductor can be payed off any suitable reel stand. A collapsible reel attached to a winch shaft makes a practical puller, although any type of power previously used for pulling can be used.

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You can depend on General Electric RF-2 disconnect switches to perform within their rating anytime, anywhere. Here's why—every rating, whether 7.5 kv or 345 kv, must run the gamut of testing extremes ranging from mechanical life tests to grueling ice tests.

Design features which contribute to the dependability of the G-E RF-2 switch include:

- **Silver-plated current transfer points** throughout the switch to provide long life;
- **One-piece switch blade** with formed contact end to eliminate the current-transfer point of a cast end-piece, which must be soldered or brazed to the blade;
- **Magnetic-loop contact fingers** to transfer current at both the contact and hinge ends of the switch—current-resisting hinge pins, springs and braids are eliminated;
- **Rotating rear insulator** with long-life tapered bearings to permit maximum force to be delivered to blade for superior ice-breaking action.

Why settle for less? For more information, contact your General Electric Sales Engineer. Or write to Section 495-08, General Electric Co., Schenectady 5, N. Y.

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ICE TESTS, life tests, electrical tests, provide proof that General Electric RF-2 disconnect switches meet or surpass all rated duty requirements.

nedy, General Electric Co. But computers can contribute to savings and operating reliability by providing (1) automatic scanning and logging of significant data, (2) off-limit supervision and alarm reflecting the degree of urgency, (3) immediate analysis of performance for correction of loading and heat rates, and (4) control of startup, operation, and shutdown procedures.

Three principal tasks confront the designer of a turbine-control system, said P. G. Ipsen, also GE:

1. Providing suitable sensing devices and operating means; many of these already have been developed for remote control.
2. Protecting the equipment against computer failure; devices for tripping off a machine for vibration, differential expansion, overspeed, or thrust are applicable.
3. Developing logical sequences for all conditions of operation; this has proved the most difficult task.

Peaking Dictates Plant Design

Power plants for peaking service must reflect the nature of the peaks —whether of relatively high load factor for daily periods or made up of several sharp peaks, said C. C. Franck, Westinghouse Electric Corp. Units for frequent operation may have relatively high steam conditions and reheat, but will need special provisions for the repeated thermal cycling. Where total operating hours will be limited, reheat can be omitted and the steam conditions held down to get maximum output from minimum investment, he said.

Special designs can combine efficient operation for base-load operation with extended peak capability at reduced efficiency, Franck continued. Normal operation would be at relatively low pressure and high temperature. Boosting the pressure, bypassing feedwater heaters, and injecting live steam at the hot reheat line would all contribute to peaking capacity at reduced efficiency, provided the turbine and condenser had room for the altered steam flow, he said.

"Of perhaps 100 methods of direct production of electric energy, only a few have the potential of economic development," said S. W. Herwald, Westinghouse Electric Corp. Useful power will be produced via the thermionic method in the near future, he said. And semiconductors offer the greatest efficiency in the thermoelectric method. But both methods share with magnetohydrodynamics the formidable obstacle of operation at 1,800 F and up and the need for materials to withstand such temperatures. The nuclear reactor may become the heat source for these new approaches, said Herwald.

A method of measuring and developing the efficiency of line crews, said J. W. McKay, Tampa Electric Co, gives department heads an index of crew performance; allows the engineering department to estimate more accurately; enables the planning division to forecast expenditures realistically; and allows the accounting department to charge capital and expense accounts on actual costs.

As the most reliable basis for determining the cost of a unit of production, Tampa Electric chose manhours. A six-month period is best for arriving at actual time vs estimated time in evaluating a foreman and crew on performance, McKay stated.

A plan of work measurement, said J. P. Gills, Appalachian Power Co, produced these added results. Performance of 17 crews increased at least 10%, estimated to be $63,000 for the division; friendly competition among crews and foreman was created; and a much better job of fitting the proper size of crew to the job has resulted.

An actual manhour time study of crew work revealed that non-productive time, due to travel, weather conditions, over-manning, poor supervision, and personal time, amounted to 50%; indirect productive time, such as material handling, customer contacts, and tailboard conferences, required 18%; and direct productive time accounted for only 32% of the total, Gills said.

Residential Underground Desirable

There is widespread agreement among Bell Telephone companies that an all-underground distribution system for residential areas is worth working toward, suggested F. M. Fister, Southern Bell Telephone & Telegraph Co. Too much emphasis sometimes is placed on the higher first cost of underground systems in urban areas. Lower maintenance costs may well justify this expense and save money in the long run.

Commenting on the growth of underground facilities, Ken Fields, Ebasco Services, Inc, said telephone companies placed 4,000 customers underground in 1956 and raised the number every year to 45,000 in 1959. They will provide an estimated 100,000 customers with underground facilities this year. This continuing trend will bring greater pressure for underground electric facilities, he offered.

Adopts 19.8 Kv for Distribution

Availability of an existing 19.8-kv subtransmission system and the anticipation of going underground over the next five years prompted Georgia Power Co to convert the Buckhead area of Atlanta from 4.16 kv to 19.8 kv. The first step in the cutover, explained W.L. Westbrook, was to install neutrals on the higher voltage system and to put regulators at all 19.8-kv substations. Conductor for 19.8 kv is 4/0 bare aluminum, with standard crossarms and pole top pins. Cutouts are rated at 27 kv and have load interrupting attachments; lightning arresters are rated at 15 kv.

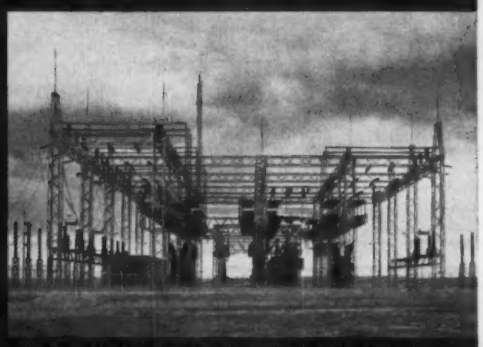
Distribution transformers are rated 12/20.8 kv with a 125-kv BIL. Regarding this BIL value, Westbrook said that power transformers serving the 19.8-kv circuits are rated 150-kv BIL. Because the Buckhead area has a high-load density, there was a natural reluctance to use 95-kv BIL equipment on these circuits.

Six important changes made in initial installations or in converting a lower voltage to 12 kv or 24 kv in new areas were reported by P. D. Huff, Duke Power Co:

- Jumper out all insulators in existing guys.
- Tie guys and all grounds to the system neutral.
- A ground wire on the pole is gapped to the insulator pin in pole-top pin installations.
- Smaller conductors are replaced as required.
- Reactors are installed to limit fault current to 100 Mva.
- Existing poles are changed out to insure proper safety clearances where needed.

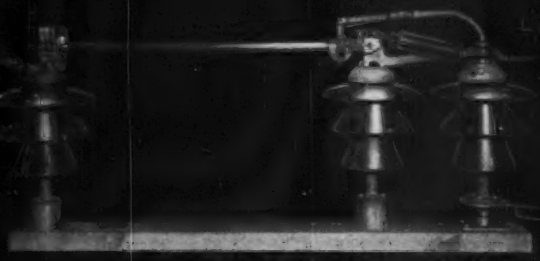
In conversions to 24 kv, Duke Power has found the self-protected type of transformer to be the best answer to the problem of providing transformer protection.

Single column of Type ATB air-blast power circuit breakers—115–460 kv.

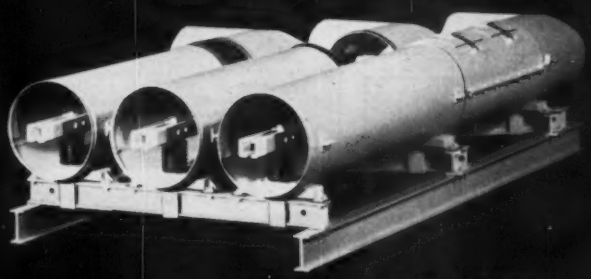


Completely designed and coordinated outdoor stations—7.5–230 kv.

Single-tank sub-transmission breakers—14.4–46 kv.



Disconnect switches—7.5–345 kv.



Isolated phase bus—14.4–34.5 kv, through 20,000 amps.

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AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.
EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

$1.80 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.80 a line an insertion.
BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

Send New Advertisements to Classified Advertising Div. of Electrical World, P. O. Box 12, N. Y. 36, N. Y.

TRANSFORMERS

3—2500 KVA G-E 69000—2400/4160Y
3—2500 KVA G-E 69000—7200/12470Y
4—2500 KVA W-H 34500—2400/4800
3—1500 KVA G-E 69000—24/4160Y
3—1500 KVA G-E 69000—7200/12470Y
4—1000 KVA Mol 7200/12470Y—4160
3—1000 KVA G-E 34500-7200/12470Y
4—500 KVA G-E 34500-7200/12470Y
6—500 KVA G-E 34500-2400/4160Y
3— 500 KVA G-E 22000—2300/4000Y
3— 500 KVA Penn. 13200—120/240
3— 333 KVA G-E 66000—2400/4160Y
3— 333 KVA Wag. 2400—120/240
1—750/938 KVA G-E 3-Ph. 3300—6900Y—TCUL equip. fan cooling
1—1000 KVA W-H 3-Ph. 33000—7200Y TCUL equipped

TRANSFORMERS WANTED

THE ELECTRIC SERVICE CO.
5316 Hetzel St.
Cincinnati 27, Ohio
47 Years' Dependable Service

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
1	12000	G.E.	115,000—46,000 L.T.C.
1	5000	West.	115,000—13,750, 3 Ph.
1	10000	West.	67,000—34,500, 3 Ph. Auto.
1	3750	G.E.	69,300—13,200, 3 Ph.
1	3000	G.E.	69,000—4340, 3 Ph.
3	500	G.E.	66,000/33,000—2300/13200
1	2500	Mol.	44,000—2400/4160, 3 Ph.
2	2500	Wagner	45,800/22,900—4160Y, 3 Ph.
3	200	West.	44,000—480
1	5000	West.	34,500—13750/6875, 3 Ph.
1	4500	West.	33,000—2500/4330, 3 Ph.
2	3000	Upsf.	34,750—4160, 3 Ph.
1	2000	Kuhl.	34,650—440, 3 Ph.
2	1500	G.E.	34,400—2520, 3 Ph.
3	1250	A.C.	33,000—480
3	500	Mol.	34,500—2300/4600
3	200	A.C.	34,500—2400/7200/12470Y
3	200	Wagner	34,500—240
2	3000	G.E.	26,400—4160Y/2400, 3 Ph.
3	833	A.C.	26,400—480
2	3000	G.E.	13,800—2640, 3 Ph.
1	2500	G.E.	13,800—2400, Unit Sub.
1	600	Stand.	13,200—2300, 3 Ph.
1	450	Penna.	13,200—2400, 3 Ph. Askarel
3	333	G.E.	13,200/22,800Y—2420/4190Y
3	100	G.E.	7,200—240/480
3	100	A.C.	6,900—2400
1	500	Kuhl.	4,800—480, 3 Ph.
3	100	G.E.	4,800—120/240
1	1000	A.C.	2,400/4,160—240, 3 Ph.
3	400	G.E.	2,300/4,000—230/460

FEEDER REGULATORS, 3 HP.—OUTDOOR

1	750	G.E.	13,200 V. 360 A. STEP
1	500	G.E.	4,160 V. 694 A. STEP
1	375	G.E.	34,500 V. 502 A. STEP
1	300	G.E.	6,600 V. 262 A. STEP
1	250	A.C.	2,400 V. 601 A. STEP

Also: FREQUENCY CHANGERS, M-G SETS, SWITCHGEAR and CIRCUIT BREAKERS, ETC.

BREW, WOLTMAN
& COMPANY, INC.
52 CHURCH ST., NEW YORK 7, N. Y.

ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.
NEW YORK 36: P. O. Box 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

POSITIONS VACANT

Wanted—Electrical Engineers. Minimum five years experience in public Utility Distribution. Transmission, Metering and Relaying. Required for permanent, responsible positions in Venezuela. Spanish an asset but not essential. Good living conditions. Starting salary of $13,000 per annum. P-3537, Electrical World.

Executive Electrical Engineer—For large Chicago electrical contracting firm; must have contractor experience. To handle top engineering and estimating department; be able to analyze estimates and costs; supervise shop drawings. Sales experience required. Salary $12,000 to $15,000 plus bonus (based on profits) which should equal salary. Additional profit sharing fund set-up for retirement, and other fringe benefits. P-4424, Electrical World.

Rapidly expanding Southwestern utility offers excellent opportunity for an equipment journeyman under age 40 to be assigned substation maintenance. Applicants should be thoroughly familiar with (6 to 8 years experience) transmission and distribution switching operations, maintainance of oil and air circuit breakers (5000—115000 Volt), substation transformers, bushings, tap changers and cooling equipment as well as auxiliary relays and batteries. Address complete resume of experience and education to: Public Service Company of New Mexico, P. O. Box 1360, Albuquerque, New Mexico. Attention: Mr. W. L. Hunt.

Plant Manager—Municipal Utility. Requires Electrical Engineer or equivalent. Experienced in Operation and Management of Municipal Light Plant. Experience required in Utility Accounting, Power Contracts and Plant Expansion Programs. Submit resume with availability and salary requirements to Box 327, Sterling, Mass.

SELLING OPPORTUNITIES AVAILABLE

Representative wanted for manufacturer of street lighting equipment pole line specialties. Full particulars. RW-9821, Electrical World.

DON'T FORGET
the box number when answering advertisements. It is the only way we can identify the advertiser to whom you are writing.

MOTORS • GENERATORS
TRANSFORMERS
NEW • REBUILT
ELECTRIC EQUIPMENT CO.
WORLD'S LARGEST INVENTORY
CALL COLLECT GL 3-6783
P O BOX 51 • ROCHESTER 1, N. Y.

SYNCHRONOUS MOTORS WANTED

One (1) 1750 to 2000 HP double or single-ended shaft, 720 RPM unity power factor snychronous motor, arranged for operation on 13,800 Volt, 3 Phrase, 60 Cycle AC service, complete with one (1) set of magnetic reduced voltage starting equipment with accessories and with an interrupting capacity of 150,000 to 250,000 KVA.

One (1) 2500-3000 HP double ended shaft, 720 RPM unity power factor synchronous motor arranged for operation on 13,800 Volt, 3 Phrase, 60 Cycle AC service, complete with one (1) set of magnetic reduced voltage starting equipment with accessories and with an interrupting capacity of 250,000 to 350,000 KVA.

WRITE Harvey Aluminum, Attn: Don Sherbon, 19200 S. Western Avenue, Torrance, California.

ARE YOU SATISFIED? WITH YOUR JOB—BUT NOT WITH YOUR FUTURE?

Then read further: Have you a background of electrical operations and line construction? Do you think you can sell? Are you willing to travel? A small progressive manufacturer whose products are leaders in their field used by power and telephone companies has an opening in the East AND MIDDLE WEST for an industrious and aggressive sales engineer. Salary, expenses and incentive bonus. Also many company benefits, if this interests you write for details.

P-3987, Electrical World
68 Post St., San Francisco 4, Calif.

LARGE POWER EQUIPMENT

Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?
BELYEA COMPANY, INC.
51 Howell St. Jersey City, N. J.
OL-3-3334

MODERN U. S. ELECTRICAL PRODUCTS in lighting household and electronic fields SOUGHT FOR DISTRIBUTION or MANUFACTURE IN HOLLAND

by old established Dutch medium manufacturers with complete sales network and technical facilities
DIRECTOR AND GENERAL MANAGER VISITING NEW YORK, please write urgently Dr. M. Goldstern
c/o The Roosevelt Hotel Madison Ave & 45th Street New York 17, N. Y.

The Meetings Calendar

JUNE

Pennsylvania Electric Association—Meter Committee, Hazleton, June 2-3.

Southeastern Electric Exchange—Industrial Power Sales Conference, Battery Park Hotel, Asheville, North Carolina, June 2-3.

• **Edison Electric Institute**—Task Force on Computer Applications for Utility Engineering, Detroit Edison Co Auditorium, 2000 Second Avenue, Detroit, June 2-3; Annual Meeting, Atlantic City, June 6-8.

Electric Companies Public Information Program—PIP Steering Committee, Claridge Hotel, Atlantic City, June 5.

American Society of Mechanical Engineers—Semi-Annual Meeting & Aviation Conference, Statler Hilton Hotel, Dallas, June 5-10; Applied Mechanics Conference, Pennsylvania State University, University Park, June 20-22.

Illuminating Engineering Society—Northeastern Regional Conference, Wentworth-By-the-Sea Hotel, Portsmouth, N. H., June 8-9; Canadian Regional Conference, Nova Scotian Hotel, Halifax, Canada, June 13-14.

National Society of Professional Engineers—Annual Meeting, Statler Hotel, Boston, June 8-11.

American Nuclear Society—Annual Meeting, Palmer House, Chicago, June 12-15.

American Society of Heating Refrigerating & Air Conditioning Engineers—Annual Meeting, Vancouver, B. C., Canada, June 13-15.

• **Wisconsin Municipal Utilities Association**—Annual Conference, Shawano, Wis., June 15-17.

• **Northwest Electric Light & Power Association**—Accounting & Business Practice Section, Benson Hotel, Portland, June 15-17.

• **International Conference for High Voltage**—Paris, France, June 15-25.

• **Oregon Rural Electric Cooperative Association** — Annual Meeting, Gearhart Hotel, Gearhart, June 16-17.

• **American Institute of Electrical Engineers**—Summer General Meeting, Atlantic City, June 20-24.

• **1960 Conference on Standards & Electronic Measurements**—National Bureau of Standards Boulder Laboratories, Boulder, Colo., June 22-24.

• **First Congress International Federation of Automatic Control**—Moscow, USSR, June 25-July 9.

• **Canadian Electrical Association**—Annual Convention, Manoir Richelieu, Murray Bay, Quebec, June 27-29.

• **National Association of Power Engineers**—Annual Convention, Jack Tar Hotel, San Francisco, June 27-30.

JULY

• **Edison Electric Institute**—Industrial Relations Committee Joint with Rocky Mountain Electrical League, Denver Hilton Hotel, July 21-22.

AUGUST

• **American Institute of Electrical Engineers**—Pacific General Meeting, El Cortez Hotel, San Diego, Aug. 8-12.

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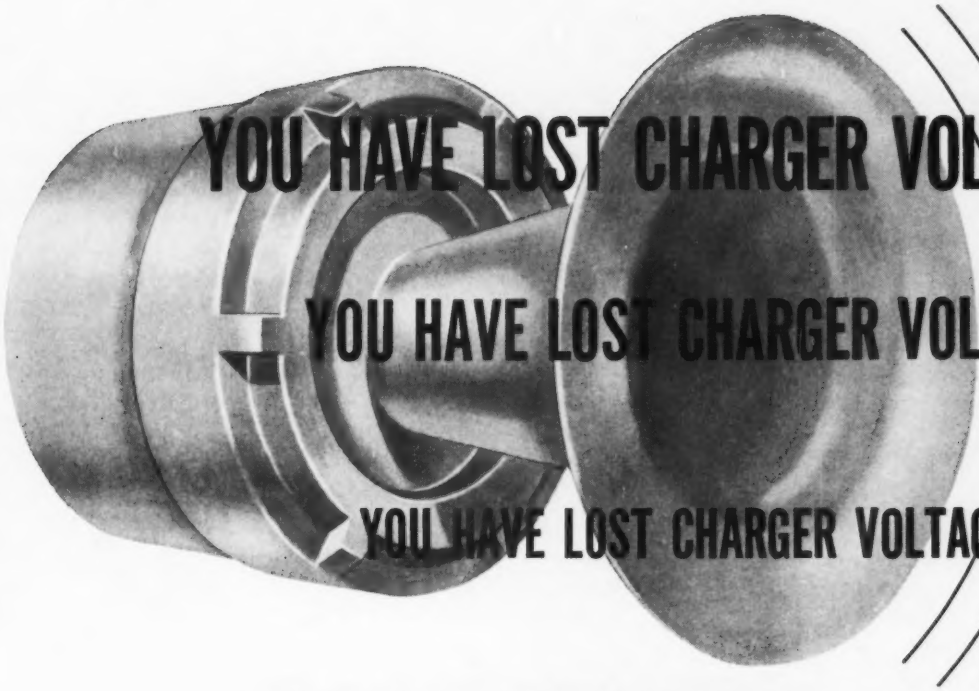


YOU HAVE LOST CHARGER VOLTAGE !

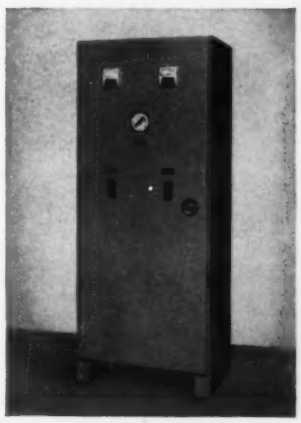
NEW EXIDE SILICON CHARGERS AVAILABLE WITH CHOICE OF ACCESSORIES TO GIVE YOU INSTANT WARNING OF TROUBLE ON CHARGER CIRCUITS

A-C failure alarm. A simple detection system that actuates a relay if charger loses a-c power. Two sets of contacts. Can be connected to blow horn, turn off remote pilot lamp, or operate other signaling device.

No-charge alarm. Will detect practically any trouble that would interfere with charging current: loss of a-c power, blown a-c fuse, open a-c switch, blown d-c fuse, etc. Can operate any audible or visual alarm device.

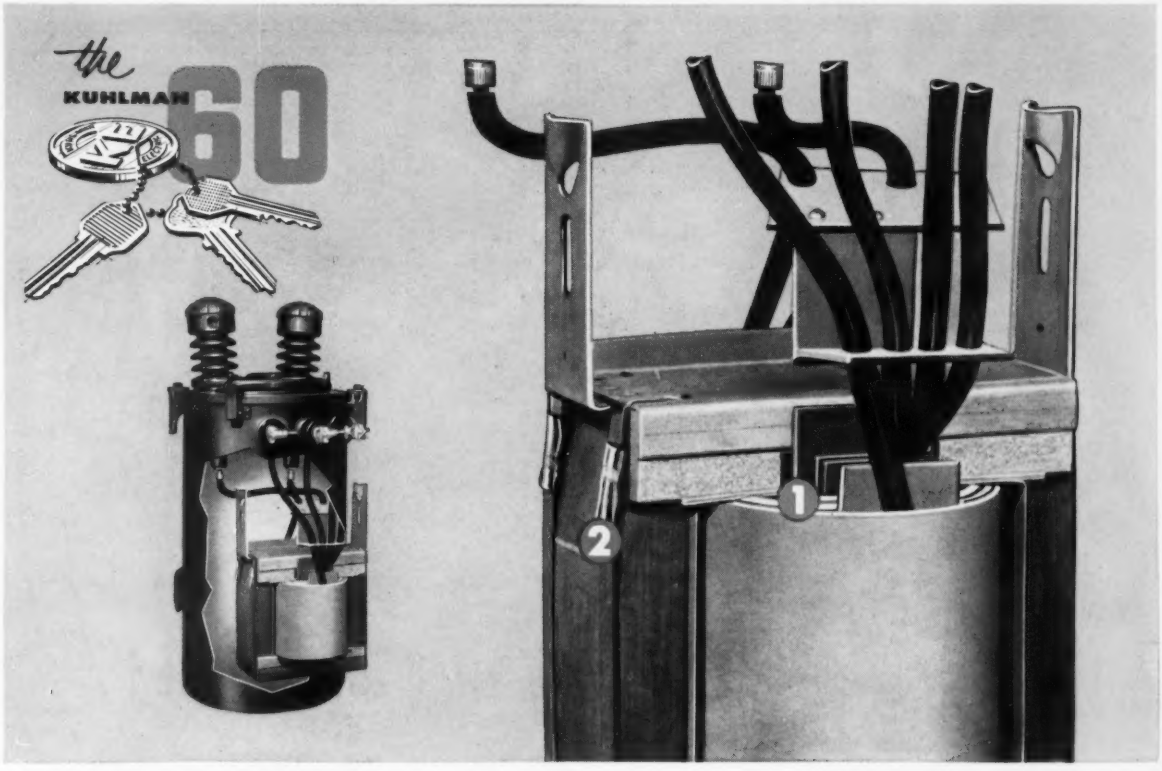
Ground detection system. Indicates if either negative or positive line to battery becomes grounded. Choice of three arrangements: voltmeter with switch, local pilot lamps, and remote audible or visual alarm device.

Low voltage alarm. Signals when battery voltage drops below pre-selected value after loss of a-c. Actuates horn or pilot lamp. Alarm turns off when a-c is restored and battery voltage reaches 3 volts over drop-out setting.



These accessories are all available on any one of the 32 sizes of Exide Model UR silicon chargers for stationary batteries. Write for details and schematic diagrams. Exide Industrial Division, The Electric Storage Battery Company, Phila. 20, Pa.

Exide®

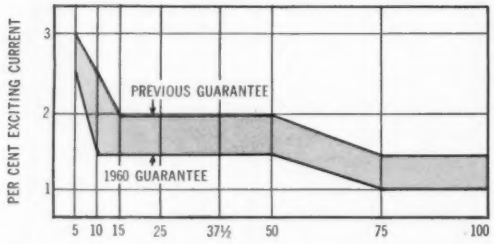


"ALL NEW" Core and Coil Saves Revenue Dollars

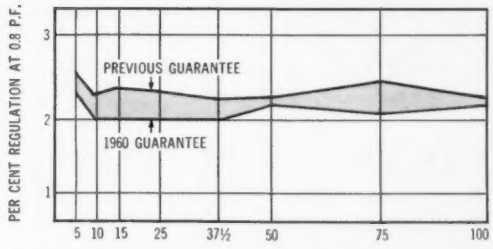
Here are four places to look for new savings in the ALL NEW Kuhlman '60 transformer:

1. *The coil*—mechanically stronger with improved electrical characteristics and an "all new" core that offers more compactness and low copper and core losses. Savings: more transformer for your dollar; less drain per transformer on your system.

2. *The core*—smaller, more efficient with fewer and shorter gaps is designed for minimum local flux concentration and maximum flux flow. Savings: More transformer per pound; more efficiency and operating economy.



3. *Lower guaranteed exciting current*—the result of new Kuhlman '60 efficiency and lower losses—covers all popular ratings as shown above. Savings: Lower exciting current values conserve generating capacity and revenue-producing power.



4. *Better guaranteed regulation*—due to the lower impedance of the new redesigned coil—offers improved regulation in all popular ratings (see above). Savings: The customer gets full power; you get full revenue.

In the face of rising costs, here's one sure way to save revenue dollars. Install ALL NEW Kuhlman '60 transformers. They are more efficient and cost less to operate.

KUHLMAN
TRANSFORMERS

KUHLMAN ELECTRIC COMPANY, Birmingham, Mich.

Manufacturers of transformers since 1894

FACTORIES: Bay City, Mich. • Crystal Springs, Miss. • Salinas, Calif.